Form 8
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Attachment

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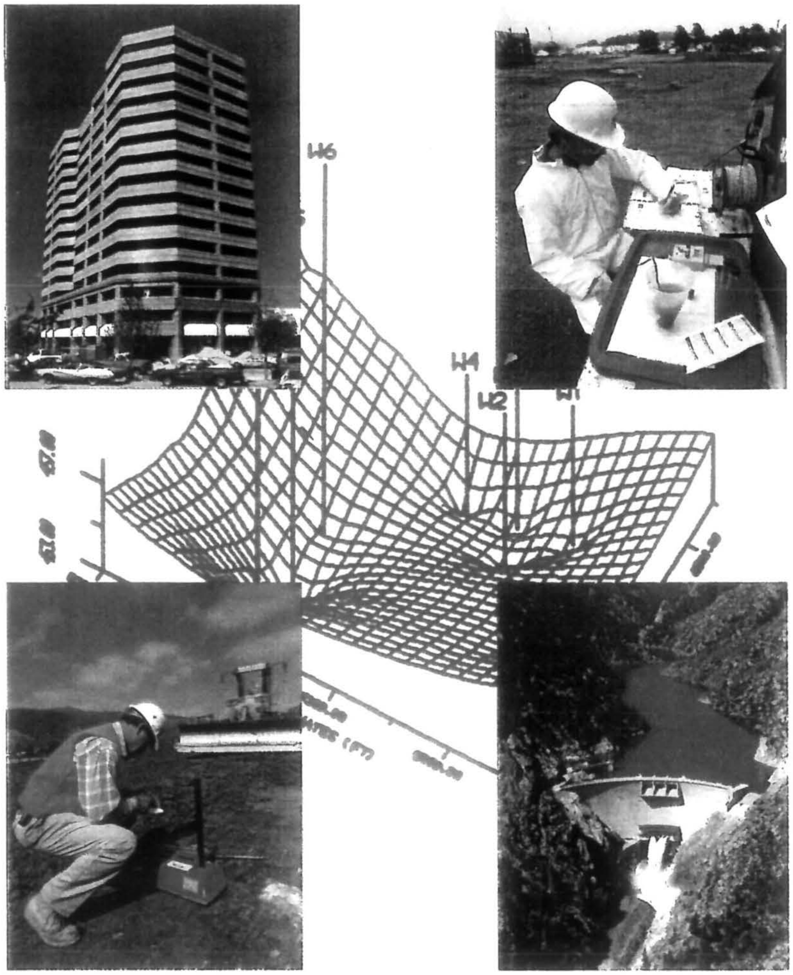
Geotechnical Engineering Analysis Report

Berryessa Creek Levee
Milpitas, California
Harza's Project No. M053-G

May 7, 1999



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Geotechnical Engineering Analysis Report

Berryessa Creek Levee
Milpitas, California
Harza's Project No. M053-G

May 7, 1999

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M053GRPT.002
05/07/99

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Geotechnical Engineering Analysis Report

Berryessa Creek Levee

Milpitas, California

1.0 INTRODUCTION

This report presents the results of our geotechnical engineering analyses for the Berryessa Creek Levee Project, located in Milpitas, California, as shown on the Site Plan, Figure 1. The purpose of our engineering analyses was to evaluate the slope stability, long-term settlement, seepage, and liquefaction potential of the existing Berryessa Creek Levees in general accordance with FEMA requirements. Subsurface exploration and laboratory testing on selected soil samples were performed by others and the results of the subsurface exploration and laboratory testing were provided to our office. Our engineering analyses as presented in this report were based on the data provided to our office.

The project site is located near the southeastern edge of the San Francisco Bay. The portion of Berryessa Creek under current evaluation includes an approximately 5,350-foot long section beginning from Western Pacific Rail Road and extending southeasterly to Hillview Drive. Based on the construction plan provided to our office, the levees of this portion of the Berryessa Creek were constructed around 1976 and improved in 1997 with up to 1.5 feet of fills over the levees between stations 26+50 and 80+52. As part of the effort to satisfy FEMA requirements on these existing levees, engineering analyses on the slope stability, long-term settlement, seepage, and liquefaction potential of the existing levees are necessary.

2.0 SCOPE OF SERVICES

The scope of work of our geotechnical engineering services included the following:

1 Review of available published and unpublished soil and geologic data on the immediate site area; and review of project related information provided to us by Nolte and Associates, Inc. such as exploratory boring logs, laboratory test results, available construction plans, flooding information, and surveying results of the existing levees.

2 Site visits to observe existing levee and site conditions.

3 Geotechnical engineering analysis of the field and laboratory test data performed by others and provided to our office. Specifically, stability analyses, long-term settlement analyses, seepage, and liquefaction potential evaluation were performed for representative sections along the creek.

4 Preparation of this geotechnical engineering analysis report.

This report has been prepared in accordance with generally accepted geotechnical engineering practices, and with our agreement with Nolte and Associates, Inc. for the exclusive use of Nolte and Associates, Inc. and their consultants for specific application to the Berryessa Creek Levee Project as described herein. In the event that there are any changes or modifications in the ownership, nature, or existing conditions of the Berryessa Creek Levee Project, the conclusions contained in this report shall not be considered valid unless 1) the project changes are reviewed by Harza and 2) conclusions presented in this report are modified or verified in writing. Reliance on this report by another must be at their risk unless we are consulted on the use or limitations. We cannot be responsible for the impacts of any changes in geotechnical and environmental standards, practices, or regulations subsequent to performance of services without our further consultation. We can neither vouch for the accuracy of information supplied by others, nor accept consequences for unconsulted use of segregated portions of this report.

3.0 SITE INVESTIGATION

Our representative visited the site along Berryessa Creek on May 6, and on December 7, 1998, we visited the site again with Mr. Khan from Santa Clara Valley Water District to select critical sections. The following discussion on the surface conditions is based on our observations during our site visits.

Subsurface exploration was performed by Pitcher Drilling Co. and laboratory testing on selected soil samples were performed by Dames and Moore. Surveying of the existing levees at selected locations was performed by Nolte and Associates, Inc. The subsurface soil conditions and laboratory test results were briefly discussed below. These discussions were based on the exploratory boring logs and laboratory test results as provided to our office.

3.1 Surface

The top of the earth levees along Berryessa Creek were generally level with a thin layer of baserock. The levee tops were about 10 feet wide. The inboard sides of the levees consisted of two slopes with a bench in the middle. These slopes were about 3 to 10 feet high with variable inclinations ranging between approximately 1½H:1V and 2H:1V (horizontal:vertical). Several feet of water was observed in the creek between the lower slopes. The outboard slopes ranged between 0 (with top of levee near the ground surface) and about 8 feet in height with variable inclinations around 1½H:1V. It appeared that erosion and sloughing created the steep slopes on both the inboard and outboard sides of the levees. The levee slopes were partially covered with vegetation consisting of grass and trees.

Erosion gullies were apparent in some areas of both the inboard and outboard levee slopes resulting in relatively steep slopes. Cracks running parallel to the levee edges were also observed on top of the levees. The erosion and cracks were generally severe along the left levee (facing to the upper station). It appeared that excessive erosion, sloughing, and possible creeping of the highly plastic clays on the slope surfaces had caused the cracking at the top of levees.

3.2 Subsurface

Eight borings were drilled by Pitcher Drilling Co. between October 2 and October 16, 1997, for this portion of the levees at the subject project site. These borings were spaced at about 500 to 1000 feet on each bank of the creek as shown on Figures 1 through 1.4, Site Plans. The boring depths ranged between 21½ and 43 ½ feet. The boring logs are attached in Appendix A of this report.

The borings generally encountered an 8- to 14-foot levee fills mainly consisting of medium stiff to very stiff clays. Under the levee fills, Borings B-7 through B-9 generally encountered soft to stiff silty clay soils to depths of about 18 to 22 feet. Underlying the clays in these areas, loose to dense sand and gravel were encountered to the maximum depth drilled of about 43 ½ feet. Borings B-10 through B-14 generally encountered medium stiff to very stiff clays with occasional lens of sand underneath the levee fills. Based on the laboratory test results, the levee fill soils had high plasticity and high expansion potential. Compaction was measure at approximately 83 percent relative compaction in accordance with ASTM Designation D 1557.

No ground water was recorded on the boring logs. We anticipate that ground water would fluctuate with the tides due to its proximity to the bay. In addition, fluctuations in the ground water level could occur due to change in seasons, variations in rainfall, and other factors.

3.3 Laboratory Testing

Laboratory testing on selected soil samples was performed by Dames and Moore. The following laboratory tests were performed.

Atterberg Limit determinations were performed on 8 soil samples. These values are generally used to classify the soil in accordance with the Unified Soil Classification System and to indicate the soil's compressibility and expansion potentials.

Gradation analyses were performed on 5 soil samples. Results of the gradation analyses were used to classify the soils.

Unconfined compression tests were performed on 8 samples of the clayey subsurface soils, and unconsolidated undrained triaxial compression tests were performed on 6 clayey soil samples. Results of these tests were used to evaluate the undrained shear strengths of the soils.

Consolidated undrained triaxial compression tests with pore pressure measurements were performed on 4 soil samples, and consolidated undrained direct shear tests were performed on 1 soil sample. The results of these tests provide effective cohesion and effective internal friction angle of the soils tested.

Consolidation tests were performed on 4 clay soil samples. The results of the consolidation tests provide information on soil compressibility and its time-dependent nature.

The laboratory tests performed also included 1 permeability test and 3 compaction curve tests. Details of the laboratory test results are attached in Appendix B of this report.

3.4 Geology and Seismicity

The subject project site is located on a gently sloping alluvial plain along the southeastern margin of the San Francisco Bay. The site is underlain by quaternary age fluvial and alluvial deposits that consist of sand, gravel, silt and clay. Bedrock at the site is estimated to be at a depth on the order of 400 to 500 feet.

The project site is located in the San Francisco Bay Area which is considered one of the most seismically active regions in the United States. Significant earthquakes have occurred in the San Francisco Bay Area and are believed to be associated with crustal movements along a system of subparallel fault zones that generally trend in a northwesterly direction. The site is located approximately 16 miles northeast, 3 miles southwest, and 5 miles southwest, respectively, of the active San Andreas, Hayward and Calaveras fault zones.

Earthquake intensities will vary throughout the Bay Area, depending upon the magnitude of earthquake, the distance of the site from the causative fault, and the type of materials underlying the site. The site will probably be subjected to at least one moderate to severe earthquake that will cause strong ground shaking. However, during such an earthquake, the hazard associated with surface fault rupture is considered to be low.

4.0 ANALYSES AND CONCLUSIONS

4.1 Slope Stability Analyses

We have performed both inboard and outboard slope stability analyses on five typical cross-sections under five different loading conditions. The cross-sections were selected by representatives from our office and Santa Clara Valley Water District and were surveyed by Nolte and Associates, Inc. The selection of the levee sections for the analyses was based on our site observations. These sections were considered critical their steep to the slope geometry, levee material properties, and their foundation soil conditions. The approximate locations of the cross-sections included:

Cross-Section	Approximate Location
A	Station 35+50, subsurface soils represented by Borings B-7 and B-9;
B	Station 40+50, subsurface soils represented by Borings B-7, B-9 and B-10;
C	Station 53+00, subsurface soils represented by Borings B-8 and B-10;
D	Station 64+50, subsurface soils represented by Borings B-11 and B-12;
E	Station 79+50, subsurface soils represented by Borings B-13 and B-14;

These cross-sections are presented in Figures 2 through 6. These cross-sections were developed based on the surveying results. The station numbers mentioned above refer to Figures 1 through 1.4, Site Plans.

These sections were analyzed for stability under the following five loading conditions:

1. "End of Construction" (Existing Condition), short-term stability after construction and water was assumed near the bottom of creek level. The undrained shear strength obtained from the unconfined compression tests and unconsolidated undrained triaxial compression tests were used for the clay soils. A total stress analysis approach was used for this loading condition. It should be noted that this is not the true "end of construction" condition since the creek levees were built around 1976, (with minor improvement in 1997), and the exploration program was performed in 1997.

2. Sudden Drawdown, with water initially at the 100-year flood level and suddenly drops to the bottom of creek level. A two-stage computation was used to evaluate this condition. The first stage computation was to calculate the effective normal stresses and the shear stresses along the potential failure surface before the undrained loading (the sudden drawdown) using the effective cohesion and internal friction angle. These are the stresses to which the soils were consolidated before undrained loading occurs. These calculated stresses from first stage were used to evaluate the undrained shear strength of clay soils which were used for the second stage computation.

   The second stage computation evaluated the safety factors of the slope during sudden drawdown (undrained loading) with a two-stage strength envelope. The procedure by Duncan, Wright and Wong (1990) was used to evaluate the undrained shear strength of clay soils for second stage computation. This procedure develops a two-stage strength envelope based on the consolidated drained triaxial compression test or consolidated undrained triaxial compression test with pore pressure measurements (for effective cohesion and internal friction angle determination), and consolidated undrained triaxial compression test (for second stage undrained shear strength determination). For free draining materials such as sand and gravel, the same effective cohesion and internal friction angle were used for both stages of the two-stage computation.

3. Intermediate Flood Stage, assumes the creek is partially full of water and steady seepage is established within portions of the levees. A nonlinear strength envelope was used to represent the clay soils and the effective cohesion and internal friction angle were used to represent sand soils for this condition. The nonlinear strength envelope for clay soils was developed from their linear strengths in terms of effective stresses (S strength) and total stresses (R strength). The results of consolidated undrained triaxial compression test with pore pressure measurements provide information on both R strength and S strength. The nonlinear strengths coincide with S strength when S strength is less than R strength and coincide with the average of S strength and R strength when S strength is larger than R strength. Different flood levels were used to evaluate the critical intermediate flood stage.

4. 100-year Flood with Steady Seepage, assumes water at the 100-year flood level and steady seepage is established within the levees. The soil properties used for this case are the same as Case No. 3.

5. 100-year Flood under Seismic (Pseudo-Static) Loading, assumes water at the 100-year flood level and an earthquake occurs. A seismic coefficient of 0.2g was used for the pseudo-static condition. This represents the upper bound value of typical seismic coefficients used for similar projects. A two-stage computation similar to Case No. 2 was performed for this case.

The outboard slopes are generally steeper than the inboard slopes. As a result, the safety factors of the outboard slopes may be lower than that of the inboard slopes under certain loading conditions. Therefore, both the inboard and outboard slopes were analyzed under each loading condition. These slope sections were analyzed with the aid of the computer program UTEXAS3. The computer program can search for a critical slip surface under different loading conditions. The program is able to perform the required analyses using modified Bishop method, Janbu method, or Spencer method. Spencer method was used for this project due to its ability of satisfying both force and moment equilibriums. The soil layers at the site were given strength properties based on the laboratory test results as provided to our office. The clays were generally over-consolidated under the existing overburden pressures. Undrained shear strength values ranged between 600 to 2,000 pound per square feet (psf), and effective cohesion of 0 to 100 psf with effective friction angle of 30 to 32 degrees were used for the clays for different loading conditions. The sands below the clays were assigned effective friction angles of 35 degrees. Detailed information on soil properties used for each soil layer is presented in Figures 2 through 6.

Our analyses of the slope stability indicate the following critical factors of safety (MFS) for each section under different loading conditions:

Cross-Section (Station No.)	**Critical Factors of Safety**				
	End of Construction	**Sudden Drawdown**	**Intermediate Flooding (steady Seepage)**	**100-Year Flooding (steady Seepage)**	**Earthquake with 100-Year Flooding**
A (35+50)	4.4 (inboard)	1.3 (inboard)	1.7 (inboard)	1.9 (outboard)	1.2 (inboard)
B (40+50)	3.4 (inboard)	1.3 (inboard)	1.6 (inboard)	1.7 (outboard)	1.2 (outboard)
C (53+00)	2.5 (inboard)	1.1 (inboard)	1.5 (inboard)	1.7 (outboard)	1.1 (inboard)
D (64+50)	3.8 (inboard)	1.8 (inboard)	2.0 (inboard)	2.1 (outboard)	1.6 (inboard)
E (79+50)	2.9 (inboard)	1.9 (inboard)	2.1 (inboard)	2.1 (inboard)	1.5 (inboard)
Minimum Factors of Safety by FEMA	1.3	1.0	1.4	1.4	1.0

The critical slip circles are approximately shown on Figures 2 through 6. Based on the analyses presented above, it is our opinion that, in general, the levee slopes as analyzed are structurally stable. However, the levees have experienced problems such as erosion, sloughing, and cracking etc., which may affect the stability of the slopes. Our opinions on the existing levee problems are presented in Section 4.5, "Maintenance Consideration".

4.2 Long-Term Settlement Analyses

The laboratory test results indicate that the clay soils at the creek site are generally over-consolidated. We understand that the existing creek levees were constructed around 1976, more than 20 years ago with minor improvement in 1997 (up to 1.5 feet of fills over portion of the levees). Therefore, it is our opinion that the settlement due to the clay primary consolidation and sand compression under the initial levee construction conditions had been essentially completed. The remaining settlement due to the fills placed in 1997 is estimated on the order of ¼ inch. If no new fills or new loads are placed on the levees, future long-term settlement of the levees due to clay primary consolidation would be negligible on the order of ¼ inch. We estimate the secondary consolidation settlement of the clays to be on the order of ¼ to ½ inch within next 20 years.

4.3 Seepage Analyses

Based on the boring logs, the levees near Station 40+50 have shallow sand deposits which are more permeable than clay soils. Therefore, one critical cross-section near Station 40+50 was selected for our seepage analysis. The section was analyzed with the aid of the computer program SEEPS2D assuming a 100-year flood. The computer program calculates the distributions of hydraulic head, flow velocity, and seepage quantity within the levee for the given soil profile and flood level. The finite element mesh of the section is presented in Figure 7. The output file of the seepage analysis is attached. Based on the results of our seepage analyses, the safety factor against uplifting near the toe of the slope is about 2½ and seepage rate across the levee near station 40+50 is about 0.429×10^{-4} ft^3/minute. In addition, the soils within the levee fill and the foundation immediately below the levee mainly consisted of clayey and silty soils. It is our opinion that the potential for piping/internal erosion within the levees near Station 40+50 is low. Based on the boring logs, the soil conditions at the other profile locations are less permeable, therefore, the potential for uplifting and piping/internal erosion along the subject sections of levees is considered to be low.

4.4 Liquefaction Potential

Soil liquefaction is a phenomenon primarily associated with saturated cohesionless soil layers located close to the ground surface. These soils lose strength during cyclic loading, such as these imposed by earthquakes. During the loss of strength, the soil acquires a "mobility" sufficient to permit both horizontal and vertical movements. Soils that are most susceptible to liquefaction are clean, loose, uniformly graded, saturated, fine-grained sands that lie close to the ground surface, a depth usually considered to be 50 feet or less.

The project site is mapped in an area of moderate liquefaction susceptibility by the Association of Bay Area Government (ABAG). The Safety Elements of the City of Milpitas also indicate that the loose sand deposits along the creeks have liquefaction potential. Based on the exploratory boring logs provided to our office, the creek is generally underlain by medium dense sand at depths of about 20 to 39 feet. These sand layers are below the ground water table. Therefore, it is our opinion that the liquefaction potential in these medium dense sand deposits is moderate to high. We performed further slope stability analyses under the earthquake loading condition using reduced strength parameters for the sand deposits (residual undrained shear strength of the liquefied sands of 500 pounds per square feet, Seed and Harder, 1989). Our analyses indicated safety factors of more than one for the sections at station 35+50, 40+50, and 53+00. The section at stations 64+50 and 79+50 are underlain by cohesive clays. Therefore, the liquefaction potential at those sections is considered low.

We evaluated the potential ground settlement due to the liquefaction of the sand deposits using a procedure by Tokimatsu and Seed (1987) and the subsurface soil information provided to our office. Our analyses indicated that the ground surface settlement would be on the order of 3 inches due to the sand liquefaction under a magnitude 7½ earthquake on the nearby Hayward fault. In addition, the work performed by Ishihara (1985) indicated that if liquefiable soils are overlain by a layer of non-liquefiable soil of sufficient thickness, the surface manifestation of liquefaction and liquefaction induced damage of improvement with shallow foundations will generally not occur or will be minimized. Based on the borings within the portion of the levees analyzed, the potentially liquefiable sands are covered by about 18 feet of clays. Therefore, it is our opinion that the affect of the liquefaction settlement on the levee surface would be minimal.

4.5 Maintenance Considerations

Slope erosion, sloughing, and cracking had occurred along the levees. It is our opinion that these were caused by the highly plastic and highly expansive clays in the levee fills. Generally, highly plastic clays are susceptible to creep and sloughing on a slope steeper than 3H:1V. Excessive erosion and sloughing will change the slope configuration and may affect the slope stability. Therefore, the levee slopes should be properly maintained and protected from erosion, sloughing, and cracking in accordance with the standard levee operation plan by Santa Clara Valley Water District.

5.0 LIMITATIONS

Our services have been provided in accordance with currently accepted geotechnical engineering principles and practice. The analysis, opinions, and conclusions submitted in this report are based in part upon the data obtained from the fourteen soil borings and laboratory test results provided to our office. Variations of subsurface conditions from those analyzed or characterized in the report are possible. In that event, it may be advisable to revisit certain analyses or assumptions.

REFERENCES

REFERENCES

1. Stephen G. Wright, (1990), UTEXAS3, A Computer Program for Slope Stability Calculations.

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3. Tokimatsu and Seed, (1987), Evaluation of Settlements in Sands due to Earthquake Shaking, ASCE Journal.

4. Seed, H.B., et al (1989), Re-Evaluation of the Slide in the Lower San Fernando Dam in the 1971 San Fernando Earthquake, Rept. No. UCB/EERC-88/04, University of California, Berkeley.

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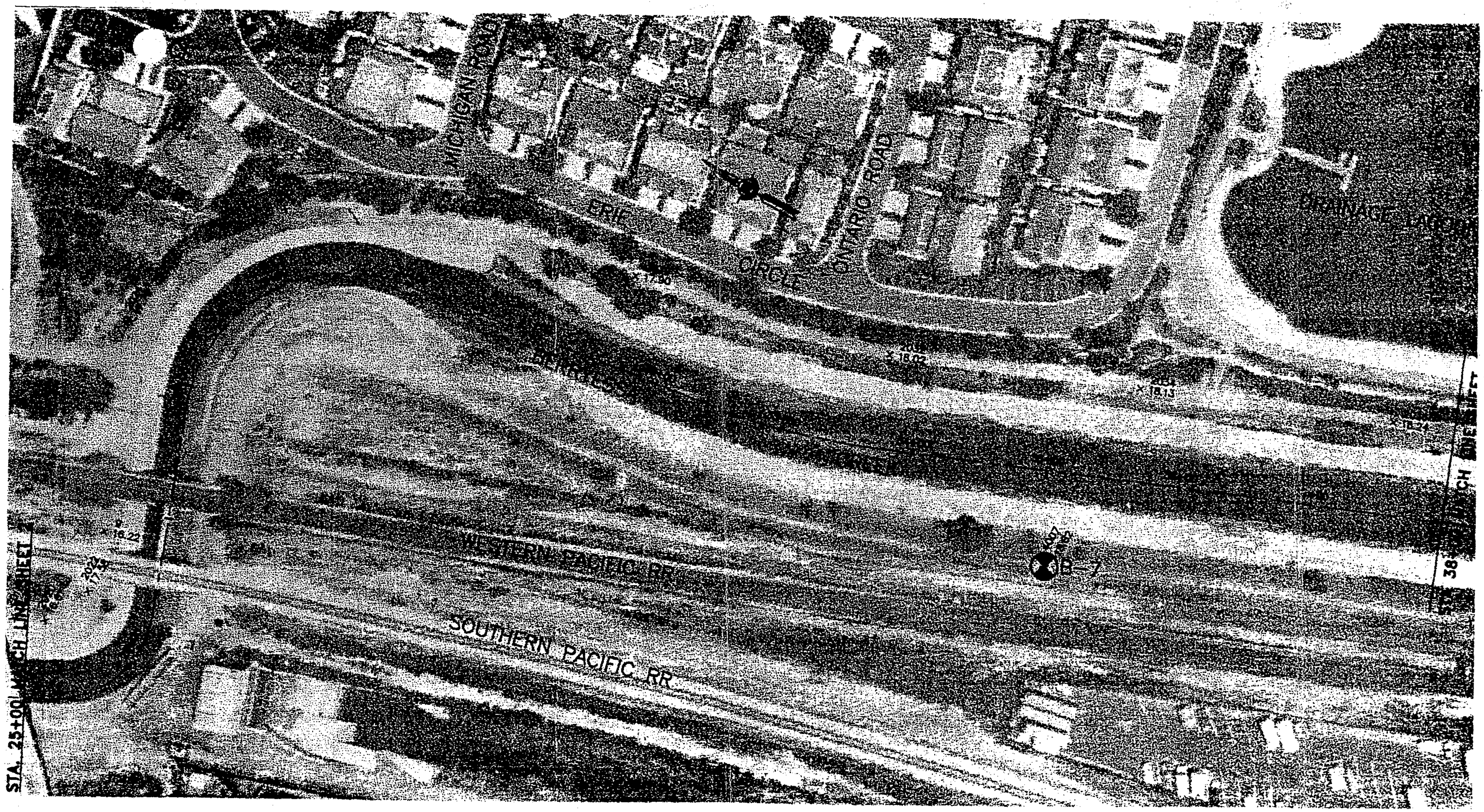
FIGURES



LEGEND:

⊗ SCVWD BORINGS

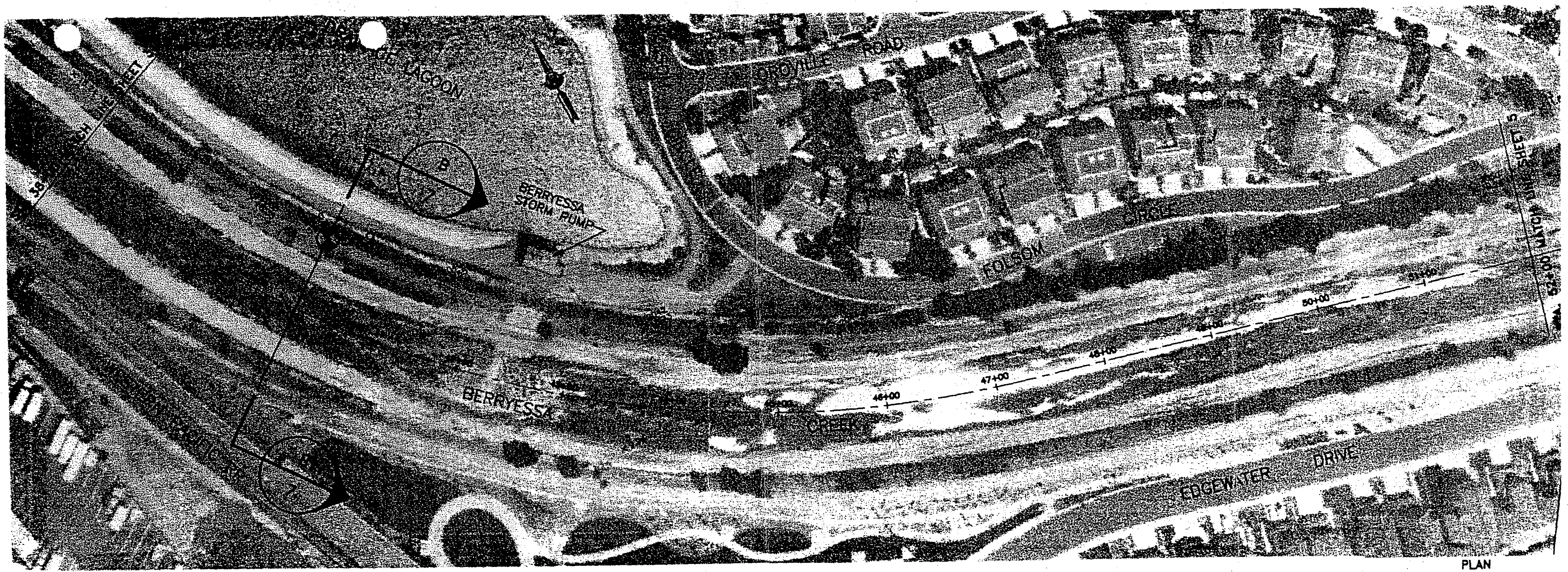
⊗ PREVIOUS BORINGS BY OTHERS

PLAN

SCALE: 1"=100'

BASE: BERRYESSA CREEK LEVEE PLAN AND PROFILE DATED
01/97 BY SANTA CLARA VALLEY WATER DISTRICT

Date 2/99 Project No. M053-G	HARZA	SITE PLAN BERRYESSA CREEK LEVEES Milpitas, California	Figure 1



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LEGEND:

- ⊗ SCVWD BORINGS
- ⊗ PREVIOUS BORINGS BY OTHERS

BASE: BERRYESSA CREEK LEVEE PLAN AND PROFILE DATED
01/97 BY SANTA CLARA VALLEY WATER DISTRICT

Date	HARZA	SITE PLAN	Figure
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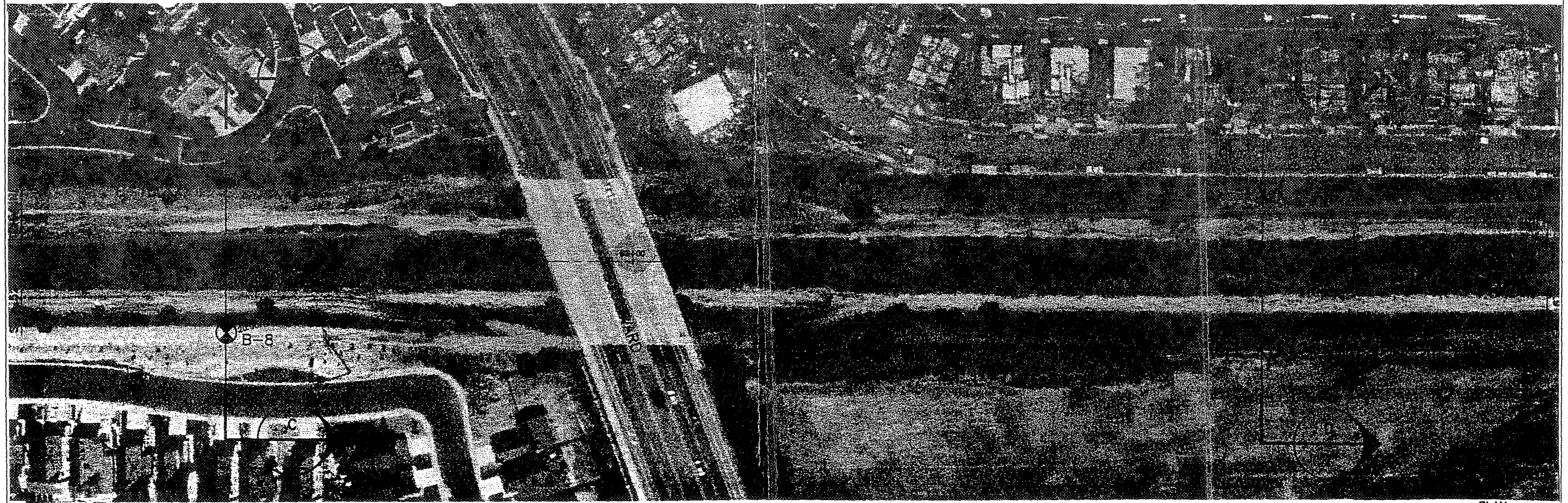
Project No.		BERRYESSA CREEK LEVEES Milpitas, California	1.2
M053-G			



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LEGEND:

⊗ SCVWD BORINGS

⊗ PREVIOUS BORINGS BY OTHERS

BASE: BERRYESSA CREEK LEVEE PLAN AND PROFILE DATED
01/97 BY SANTA CLARA VALLEY WATER DISTRICT

Date	HARZA	SITE PLAN	Figure
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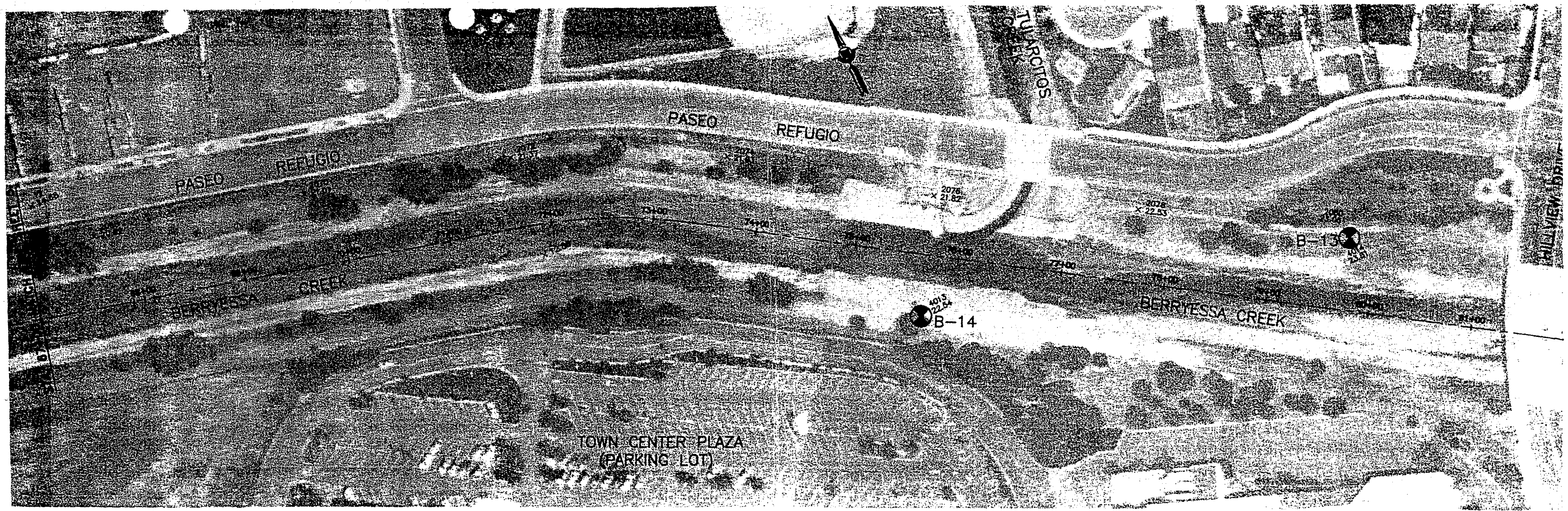
M053-G			



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● SCVWD BORINGS

⊗ PREVIOUS BORINGS BY OTHERS

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BASE: BERRYESSA CREEK LEVEE PLAN AND PROFILE DATED
01/97 BY SANTA CLARA VALLEY WATER DISTRICT

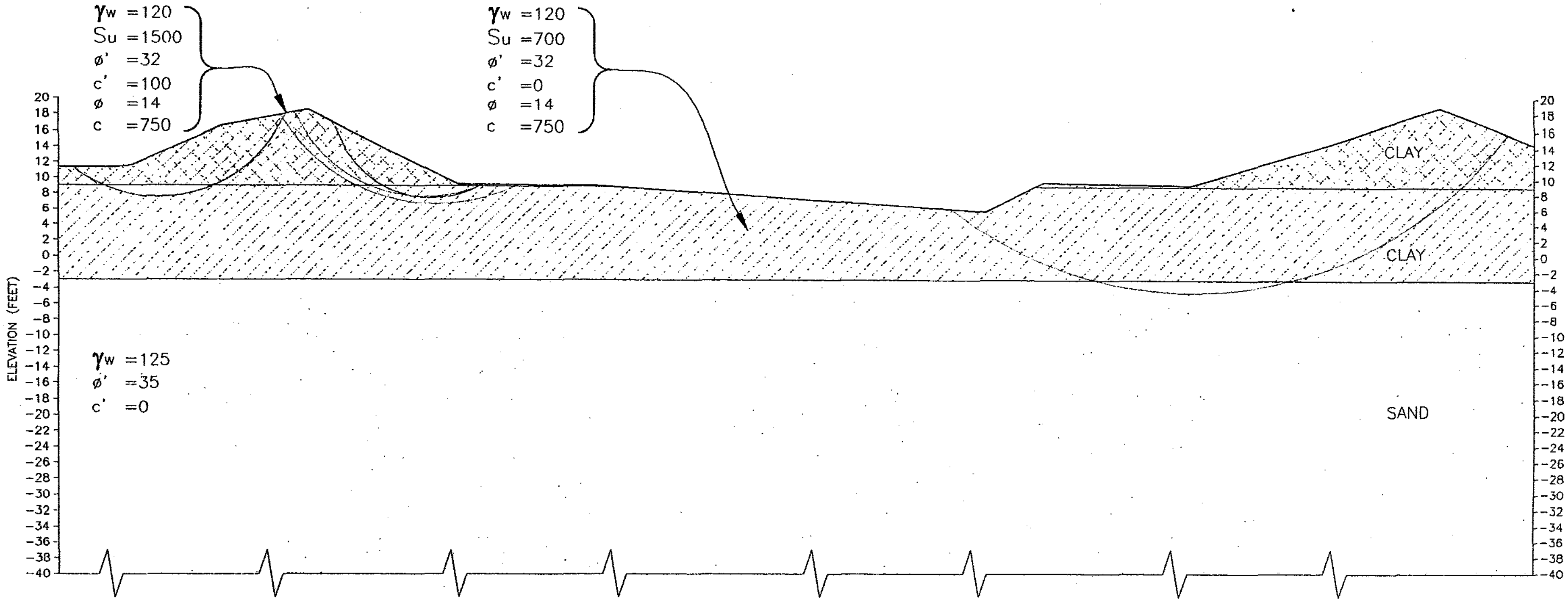
Date
2/99
Project No.
M053-G

HARZA

SITE PLAN

BERRYESSA CREEK LEVEES
Milpitas, California

Figure
1.4



LEGEND

- ———— END OF CONSTRUCTION
- ———— SUDDEN DRAWDOWN FROM 100 YEAR STORM
- ———— INTERMEDIATE FLOOD STAGE WITH STEADY SEEPAGE
- ———— 100 YEAR STORM WITH STEADY SEEPAGE
- ———— EARTHQUAKE + 100 YEAR STORM

γ_w – TOTAL UNIT WEIGHT (PCF)
Su – UNDRAINED SHEAR STRENGTH (PSF)
ø' – EFFECTIVE FRICTION ANGLE (DEGREE) (S TEST)
c' – EFFECTIVE COHESION (PSF) (S TEST)
ø – FRICTION ANGLE (DEGREE) (R TEST)
c – COHESION (PSF) (R TEST)

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APP'D BY:	AW
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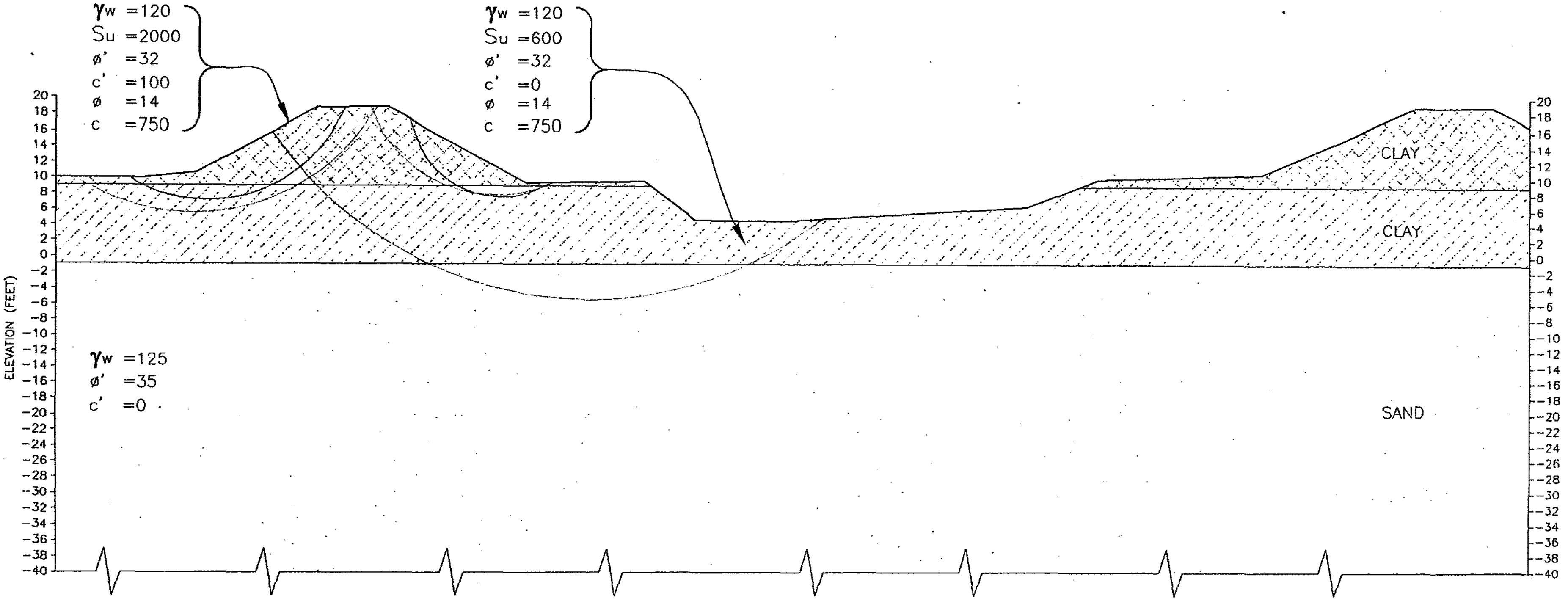
STATION 35+50

BERRYESSA CREEK LEVEES
Milpitas, California

FIGURE
2
PROJECT No.
M053-G



LEGEND

———— END OF CONSTRUCTION
———— SUDDEN DRAWDOWN FROM 100 YEAR STORM
———— INTERMEDIATE FLOOD STAGE WITH STEADY SEEPAGE
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ø – FRICTION ANGLE (DEGREE) (R TEST)
c – COHESION (PSF) (R TEST)

BASE: CROSS SECTION SURVEYED BY NOLTE & ASSOCIATES INC.

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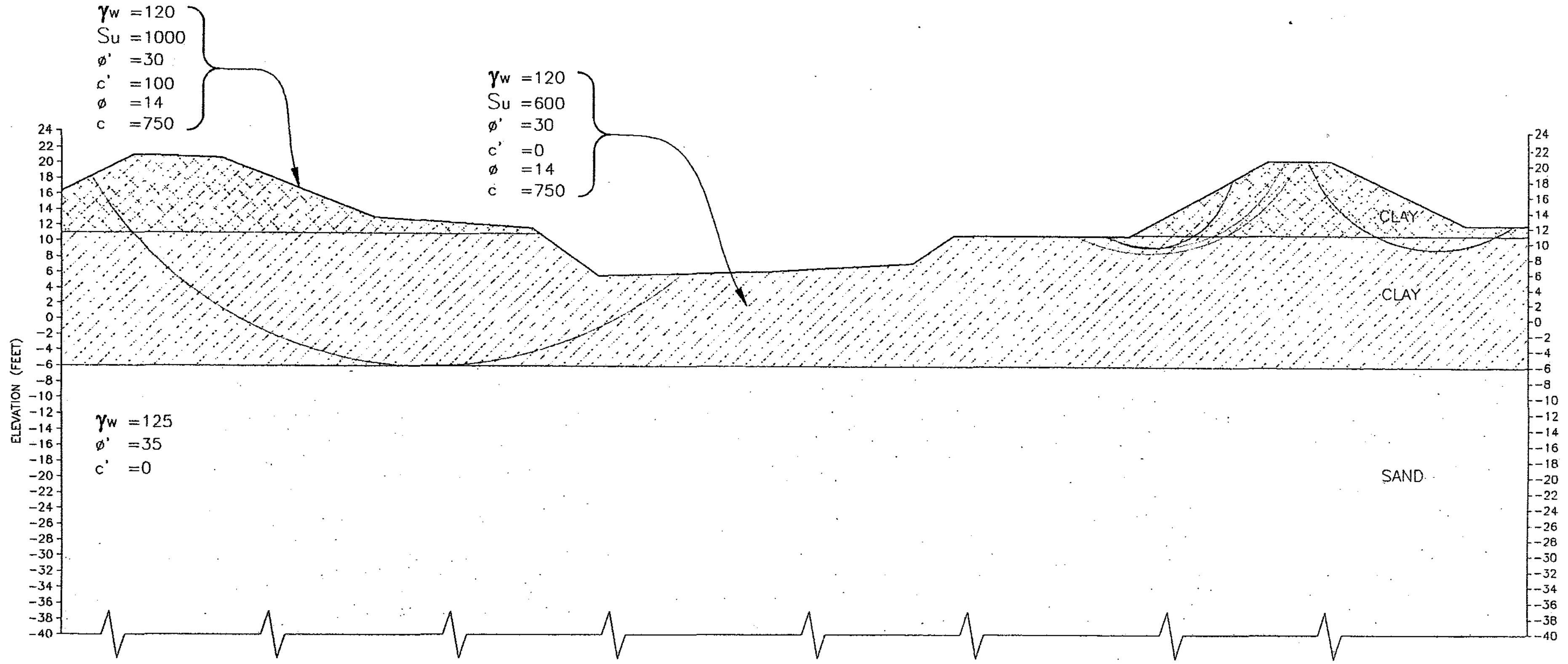
STATION 40+50

BERRYESSA CREEK LEVEES
Milpitas, California

FIGURE
3
PROJECT No.
M053-G



LEGEND

————	END OF CONSTRUCTION
————	SUDDEN DRAWDOWN FROM 100 YEAR STORM
————	INTERMEDIATE FLOOD STAGE WITH STEADY SEEPAGE
————	100 YEAR STORM WITH STEADY SEEPAGE
————	EARTHQUAKE + 100 YEAR STORM

γ_w – TOTAL UNIT WEIGHT (PCF)
Su – UNDRAINED SHEAR STRENGTH (PSF)
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c' – EFFECTIVE COHESION (PSF) (S TEST)
ø – FRICTION ANGLE (DEGREE) (R TEST)
c – COHESION (PSF) (R TEST)

BASE: CROSS SECTION SURVEYED BY NOLTE & ASSOCIATES INC.

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△			
△			
△			
MARK	BY	CHK'D	DATE

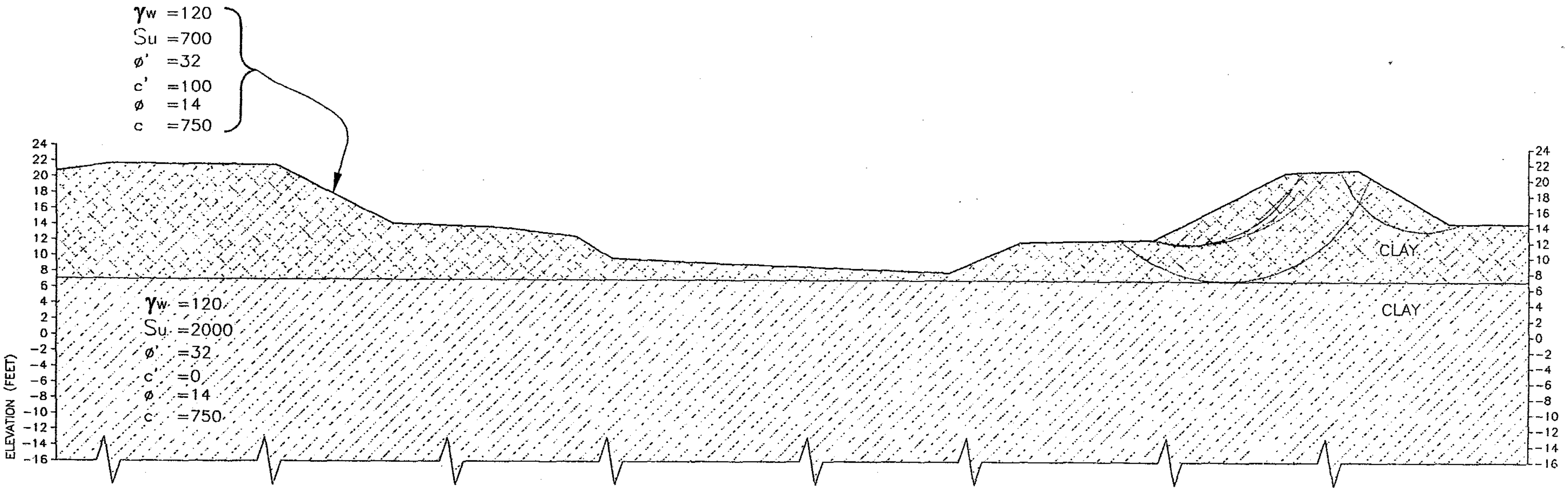
HARZA
Consulting Engineers and Scientists
425 Roland Way.
Oakland, California. 94621
Tel: (510)568-4001 – Fax:(510)568-2205

DRAWN BY:	DR
PREP'D BY:	AW
APP'D BY:	AW
SCALE:	1" = 20'
DATE:	07JAN99
DWG FILE:	M053G-04

STATION 53+00

BERRYESSA CREEK LEVEES
Milpitas, California

FIGURE
4
PROJECT No.
M053-G



LEGEND

- END OF CONSTRUCTION
- SUDDEN DRAWDOWN FROM 100 YEAR STORM
- INTERMEDIATE FLOOD STAGE WITH STEADY SEEPAGE
- 100 YEAR STORM WITH STEADY SEEPAGE
- EARTHQUAKE + 100 YEAR STORM

γ_w – TOTAL UNIT WEIGHT (PCF)
Su – UNDRAINED SHEAR STRENGTH (PSF)
ø' – EFFECTIVE FRICTION ANGLE (DEGREE) (S TEST)
c' – EFFECTIVE COHESION (PSF) (S TEST)
ø – FRICTION ANGLE (DEGREE) (R TEST)
c – COHESION (PSF) (R TEST)

BASE: CROSS SECTION SURVEYED BY NOLTE & ASSOCIATES INC.

MARK	BY	CHK'D	DATE
△			
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HARZA
Consulting Engineers and Scientists
425 Roland Way.
Oakland, California. 94621
Tel: (510)568-4001 – Fax:(510)568-2205

DRAWN BY:	DR
PREP'D BY:	AW
APP'D BY:	AW
SCALE:	1" = 20"
DATE:	07JAN99
DWG FILE:	M053G-05

STATION 64+50

BERRYESSA CREEK LEVEES
Milpitas, California

FIGURE
5
PROJECT No.
M053-G

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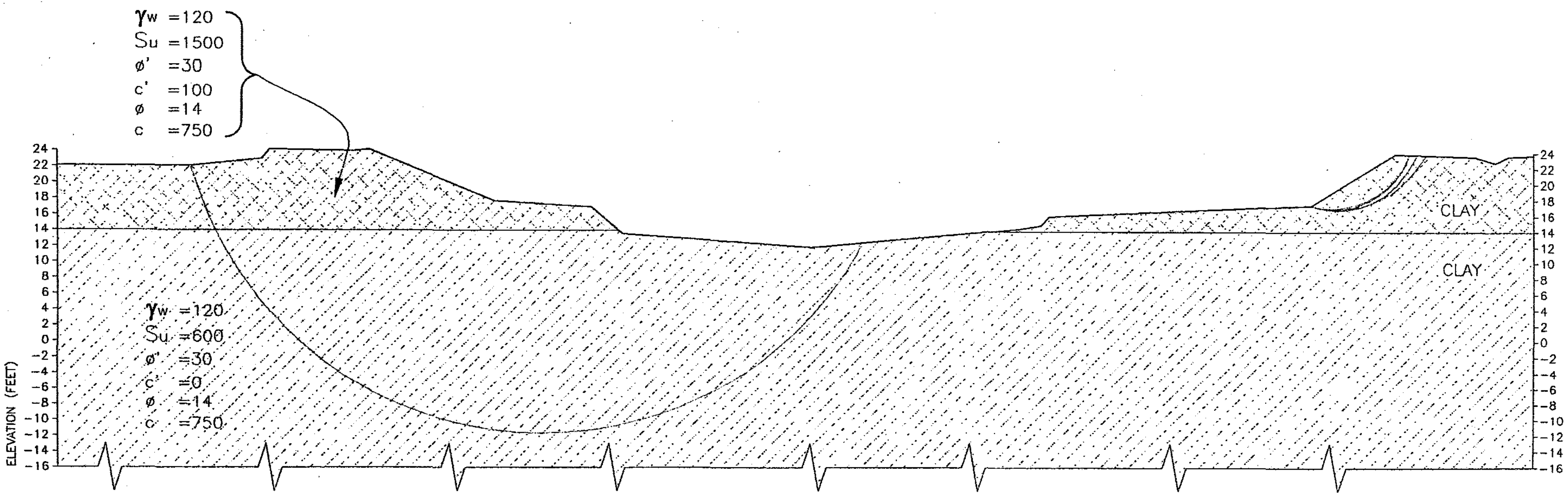

LEGEND

- END OF CONSTRUCTION
- SUDDEN DRAWDOWN FROM 100 YEAR STORM
- INTERMEDIATE FLOOD STAGE WITH STEADY SEEPAGE
- 100 YEAR STORM WITH STEADY SEEPAGE
- EARTHQUAKE + 100 YEAR STORM

γ_w – TOTAL UNIT WEIGHT (PCF)
Su – UNDRAINED SHEAR STRENGTH (PSF)
ø' – EFFECTIVE FRICTION ANGLE (DEGREE) (S TEST)
c' – EFFECTIVE COHESION (PSF) (S TEST)
ø – FRICTION ANGLE (DEGREE) (R TEST)
c – COHESION (PSF) (R TEST)

BASE: CROSS SECTION SURVEYED BY NOLTE & ASSOCIATES INC.

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MARK	BY	CHK'D	DATE
△			
△			
△			

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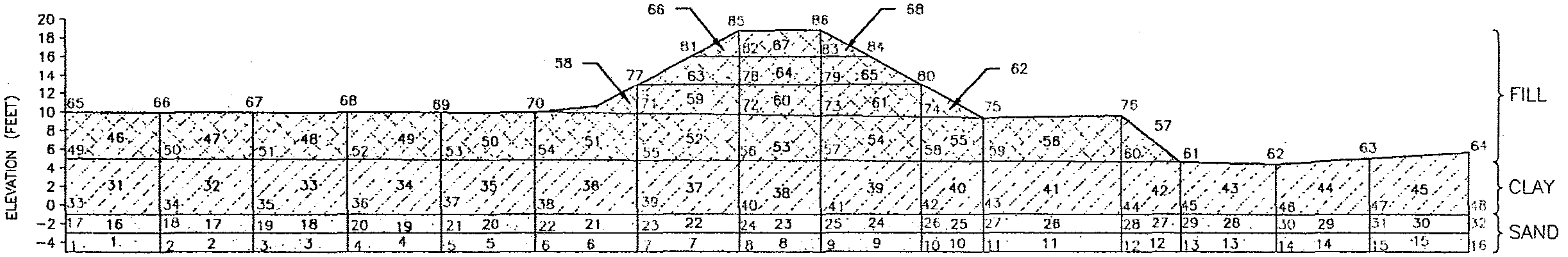
Consulting Engineers and Scientists
425 Roland Way.
Oakland, California. 94621
Tel: (510)568-4001 – Fax:(510)568-2205

DRAWN BY:	DR
PREP'D BY:	AW
APP'D BY:	AW
SCALE:	1" = 20"
DATE:	07JAN99
DWG FILE:	M053G-06

STATION 79+50

BERRYESSA CREEK LEVEES
Milpitas, California

FIGURE
6
PROJECT No.
M053-G



FILL: PERMEABILITY = 1 x 10^{-6} cm/sec.
CLAY: PERMEABILITY = 1 x 10^{-6} cm/sec.
SAND: PERMEABILITY = 1 x 10^{-3} cm/sec.

BASE: CROSS SECTION SURVEYED BY NOLTE & ASSOCIATES INC.

MARK	BY	CHK'D	DATE
△			
△			
△			

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Consulting Engineers and Scientists
425 Roland Way.
Oakland, California. 94621
Tel: (510)568-4001 – Fax:(510)568-2205

DRAWN BY:	DR
PREP'D BY:	AW
APP'D BY:	AW
SCALE:	1" = 20"
DATE:	15JAN99
DWG FILE:	M053G-07

SEEPAGE ANALYSIS

BERRYESSA CREEK LEVEES
Milpitas, California

FIGURE
7
PROJECT No.
M053-G

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APPENDIX A

Exploratory Boring Logs

MAJOR DIVISIONS					TYPICAL NAMES
COARSE-GRAINED SOILS MORE THAN HALF IS COARSER THAN NO. 200 SIEVE	GRAVELS MORE THAN HALF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE SIZE	CLEAN GRAVELS WITH LITTLE OR NO FINES	GW	○	WELL GRADED GRAVELS WITH OR WITHOUT SAND, LITTLE OR NO FINES
			GP	●	POORLY GRADED GRAVELS WITH OR WITHOUT SAND, LITTLE OR NO FINES
		GRAVELS WITH OVER 12% FINES	GM	▤	SILTY GRAVELS, SILTY GRAVELS WITH SAND
			GC	▨	CLAYEY GRAVELS, CLAYEY GRAVELS WITH SAND
	SANDS MORE THAN HALF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE SIZE	CLEAN SANDS WITH LITTLE OR NO FINES	SW	•	WELL GRADED SANDS WITH OR WITHOUT GRAVEL, LITTLE OR NO FINES
			SP	⁘	POORLY GRADED SANDS WITH OR WITHOUT GRAVEL, LITTLE OR NO FINES
		SANDS WITH OVER 12% FINES	SM	▥	SILTY SANDS WITH OR WITHOUT GRAVEL
			SC	▨	CLAYEY SANDS WITH OR WITHOUT GRAVEL
FINE-GRAINED SOILS MORE THAN HALF IS FINER THAN NO. 200 SIEVE	SILTS AND CLAYS LIQUID LIMITS 50% OR LESS		ML	▥	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTS WITH SANDS AND GRAVELS
			CL	▧	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, CLAYS WITH SANDS AND GRAVELS, LEAN CLAYS
			OL	┆	ORGANIC SILTS OR CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS LIQUID LIMITS GREATER THAN 50%		MH	▥	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS, FINE SANDY OR SILTY SOILS, ELASTIC SILTS
			CH	▨	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH	▧	ORGANIC SILTS OR CLAYS OF MEDIUM TO HIGH PLASTICITY
HIGHLY ORGANIC SOILS			Pt	≋	PEAT AND OTHER HIGHLY ORGANIC SOILS

UNIFIED SOIL CLASSIFICATION – ASTM D2487 – 85

Perm — Permeability
Consol — Consolidation
LL — Liquid Limit (%))
PI — Plastic Index (%)
G_s — Specific Gravity
MA — Particle Size Analysis
■ — "Undisturbed" Sample
☒ — Bulk or Classification Sample

	Shear Strength (psf)	Confining Pressure	
TxUU (FM) or (S)	3200	(2600)	Unconsolidated Undrained Triaxial Shear (field moisture or saturated)
TxCU (P)	3200	(2600)	Consolidated Undrained Triaxial Shear (with or without pore pressure measurement)
TxCD	3200	(2600)	Consolidated Drained Triaxial Shear
SSCU (P)	3200	(2600)	Simple Shear Consolidated Undrained (with or without pore pressure measurement)
SSCD	3200	(2600)	Simple Shear Consolidated Drained
DSCD	2700	(2000)	Consolidated Drained Direct Shear
DSCU	2000	(1000)	Consolidated Undrained Direct Shear
UC	470		Unconfined Compression
LVS	700		Laboratory Vane Shear

KEY TO TEST DATA

Santa Clara Valley Water District

Soil Classification and Test Data Key

Berryessa Creek Levee
Milpitas, California

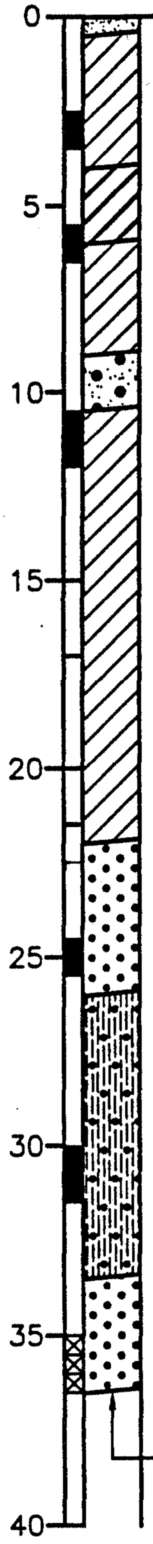
PLATE

Drawn	Job Number	Approved	Date	Revised	Date
R. AGREDA	401801	M. KHAN	01/20/98	R. AGREDA	06/15/98

FILE: G:\DWGS\SDSKPROJ\4018_010\SHEETS\DATA_KEY\DATA_KEY.DWG

Equipment Rotary Wash

Top Elevation 18.8 Feet **Date** 10/07/97



Laboratory Tests	Blows/foot	Moisture Content %	Dry Density (psf)	
				6" Aggregate Base
				Brown Silty Clay (CL), stiff (fill)
	15*			
				Gray Fat Clay (CH), stiff (fill)
	12*			
				Brown Sandy Clay (CL), with some gravel, stiff (fill)
				Brown and Gray Gravel (GP), fine grainec loose (fill)
TxUU 600(750)	7*	35	83	Brown Silty Clay (CL), medium stiff
	Push			No recovery
	Push			No recovery
				Brown Sand (SP), fine grained medium dense
	14*			
				Brown Silty Sand (SM), fine grained medium dense
	20*			
				Gray Sand (SP), with some gravel medium to coarse grained, medium dense,
	24			
				Bottom @ 36.5 Feet

Santa Clara Valley Water District

LOG OF BORING B-7

Berryessa Creek Levee

Milpitas, California

PLATE

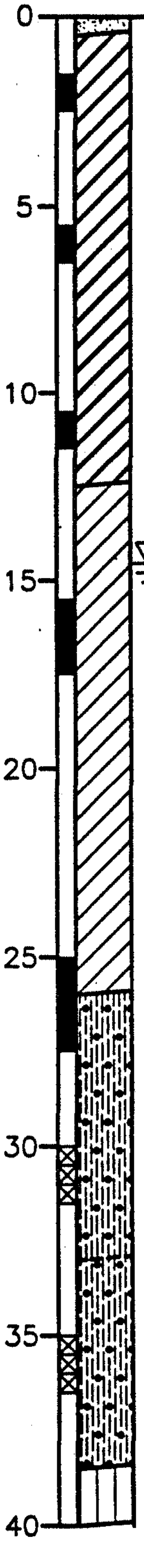
Drawn	Job Number	Approved	Date	Revised	Date
R. AGREDA	401801	M. KHAN	01/20/98	R. AGREDA	06/15/9

FILE: G:\DWGS\SDSKPROJ\4018_010\SHEETS\BERB-07A.DWG

Equipment Rotary Wash

Top Elevation 20.9 Feet **Date** 10/07/97

Laboratory Tests	Blows/foot	Moisture Content %	Dry Density (psf)
LL=60, PI=39	17*		
	18*		
TxUU 3033(800)	17*	27	95
TxCU	7*	24	104
	Push		
MA	10		
	18		



6" Aggregate Base

Brown and Gray Fat Clay (CH), with traces of wood chips, roots, and gravel, very stiff (fill)

Brown Silty Clay (CL), medium stiff, getting solfter with depth

▽ Water Level (02/10/98)

Gray Silty Sand (SM), fine grained, loose to medium dense

Brown Silty Sand (SM), fine grained, medium dense

Brown Sandy Silt (ML)

Santa Clara Valley Water District

LOG OF BORING B-8

PLATE

Berryessa Creek Levee

Milpitas, California

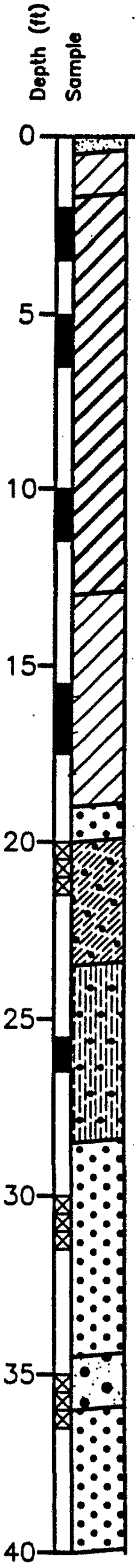
Drawn	Job Number	Approved	Date	Revised	Date
R. AGREDA	401801	M. KHAN	01/20/98	R. AGREDA	06/15/98

FILE: G:\DWGS\SDSKPROJ\4018_010\SHEETS\BERB-08A.DWG

Equipment Rotary Wash

Top Elevation 18.4 Feet **Date** 10/08/97

Laboratory Tests	Blows/foot	Moisture Content %	Dry Density (psf)
LL=59, PI=37	20*		
Perm	15*		
TxCU	18*	27	97
LL=42, PI=26 TxCU Consol	13*	24	103
MA	13		
DSCU	14*	26	98
MA	25		
	39		



6" Aggregate Base
Light Brown Silty Clay (CL), stiff (fill)
Dark Brown Fat Clay (CH), very stiff (fill)
Brown Sandy Clay (CL), stiff
Brown Sand (SP), coarse grained
Brown Clayey Sand (SC), fine grained, medium dense
Brown Silty Sand (SM), fine grained, medium dense
Gray Sand (SP), fine to medium grained, medium dense
Fine Gravel (GP), with little sand, dense
Gray Sand (SP), with some gravel, coarse grained, dense

Santa Clara Valley Water District

LOG OF BORING B-9
Berryessa Creek Levee
Milpitas, California

PLATE

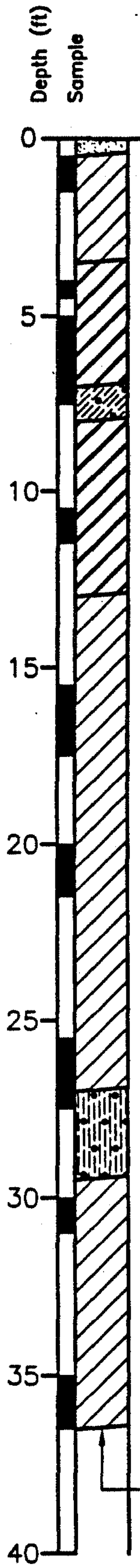
Drawn	Job Number	Approved	Date	Revised	Date
R. AGREDA	401801	M. KHAN	01/20/98	R. AGREDA	06/15/98

FILE: G:\DWGS\SDSKPROJ\4018_010\SHEETS\BERB-09A.DWG

Equipment Rotary Wash

Top Elevation 20.77 Feet **Date** 10/08/97

Laboratory Tests	Blows/foot	Moisture Content %	Dry Density (psf)
	15*		
	9*		
LL=84, PI=55 UC 1989	Push	33	89
	17*		
	Push		
TxUU 1110(1200)	9*	27	99
	Push		
	13*		
	27*		



8" Aggregate Base
Brown Silty Clay (CL), with gravel, stiff (fill)

Dark Brown Fat Clay (CH), medium stiff (fill)

Brown Clayey Sand (SC), (fill)

Dark Brown Fat Clay (CH), very stiff (fill)

Brown Silty Clay (CL), medium stiff to stiff

Brown Silty Sand (SM), fine grained

Brown Silty Clay (CL), stiff to very stiff

Bottom @ 36.5 Feet

Santa Clara Valley Water District

LOG OF BORING B-10

Berryessa Creek Levee
Milpitas, California

PLATE

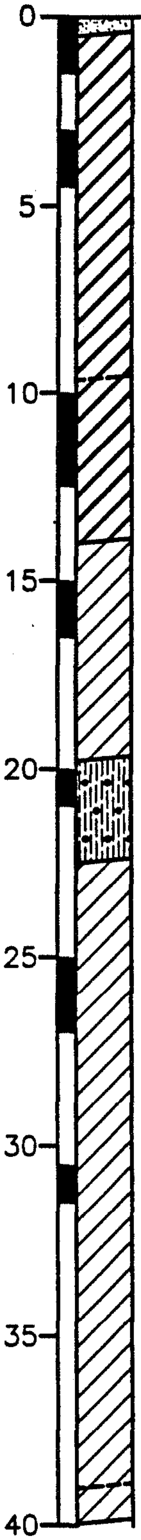
Drawn	Job Number	Approved	Date	Revised	Date
R. AGREDA	401801	M. KHAN	01/20/98	R. AGREDA	06/15/98

FILE: G:\DWGS\SDSKPROJ\4018_010\SHEETS\BERB-10A.DWG

Equipment Rotary Wash

Top Elevation 21.2 Feet **Date** 10/09/97

Laboratory Tests	Blows/foot	Moisture Content %	Dry Density (psf)
	23*		
LL=61, PI=40 TxCU	19*	24	95
Consol	Push	36	86
	16*		
TxCU	14*	23	104
Consol	Push	21	105
	17*		



8" Aggregate Base

Dark Brown Fat Clay (CH), very stiff (fill)

Gray and Brown Fat Clay (CH), stiff

Brown Silty Clay (CL), very stiff

Light Brown Clayey Sand (SC), medium dense

Brown Silty Clay (CL), stiff to very stiff

Brown Sandy Clay (CL), stiff

Santa Clara Valley Water District

LOG OF BORING B-11

Berryessa Creek Levee
Milpitas, California

PLATE

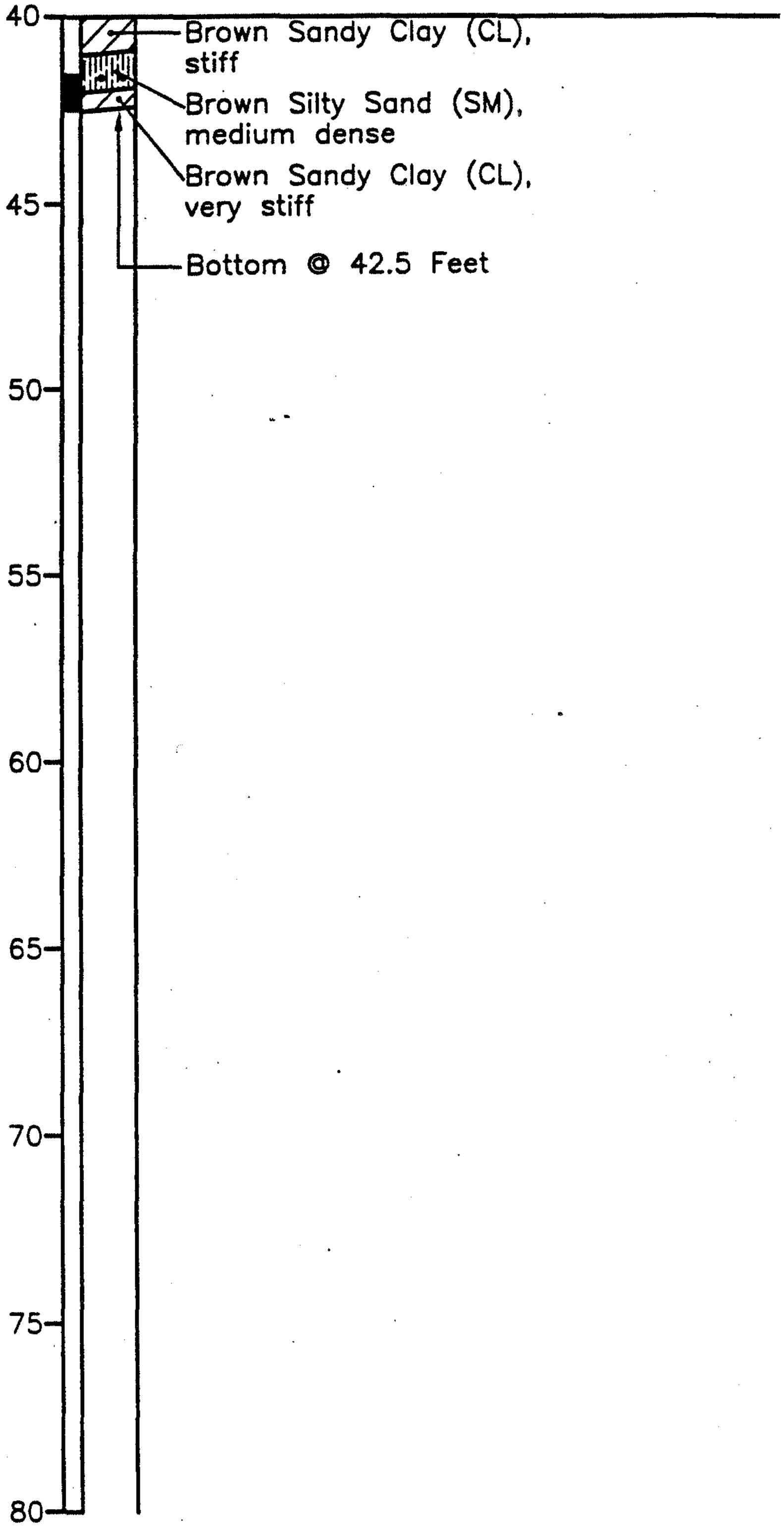
Drawn	Job Number	Approved	Date	Revised	Date
R. AGREDA	401801	M. KHAN	01/20/98	R. AGREDA	06/15/98

FILE: G:\DWGS\SDSKPROJ\4018_010\SHEETS\BERB-11A.DWG

Laboratory Tests | Blows/foot | Moisture Content % | Dry Density (psf) | Depth (ft) | Sample

(Continuation of Log)

Blows/foot: 26*



Brown Sandy Clay (CL), stiff

Brown Silty Sand (SM), medium dense

Brown Sandy Clay (CL), very stiff

Bottom @ 42.5 Feet

Santa Clara Valley Water District

LOG OF BORING B-11

Berryessa Creek Levee

Milpitas, California

PLATE

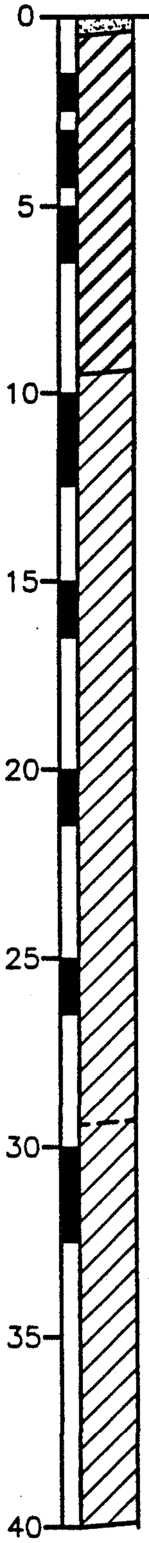
Drawn	Job Number	Approved	Date	Revised	Date
R. AGREDA	401801	M. KHAN	01/20/98	R. AGREDA	06/15/9

FILE: G:\DWGS\SDSKPROJ\4018_010\SHEETS\BERB-11B.DWG

Equipment Rotary Wash

Top Elevation 21.7 Feet **Date** 10/09/97

Laboratory Tests	Blows/foot	Moisture Content %	Dry Density (psf)	Depth (ft)	Description
				0	6" Aggregate Base Dark Brown Fat Clay (CH), medium stiff to stiff (fill)
	16*				
	7*				
LL=78, PI=50 UC 692	9*	36	80	5	
				10	Brown Silty Clay (CL), stiff to very stiff
	Push				
TxUU 2280(1000)	14*	26	99	15	
				20	
	21*				
				25	
	19*				
				30	Tan Brown Silty Clay (CL), hard
	37*				
				35	
				40	



LOG OF BORING B-12 **PLATE**

Santa Clara Valley Water District

Berryessa Creek Levee

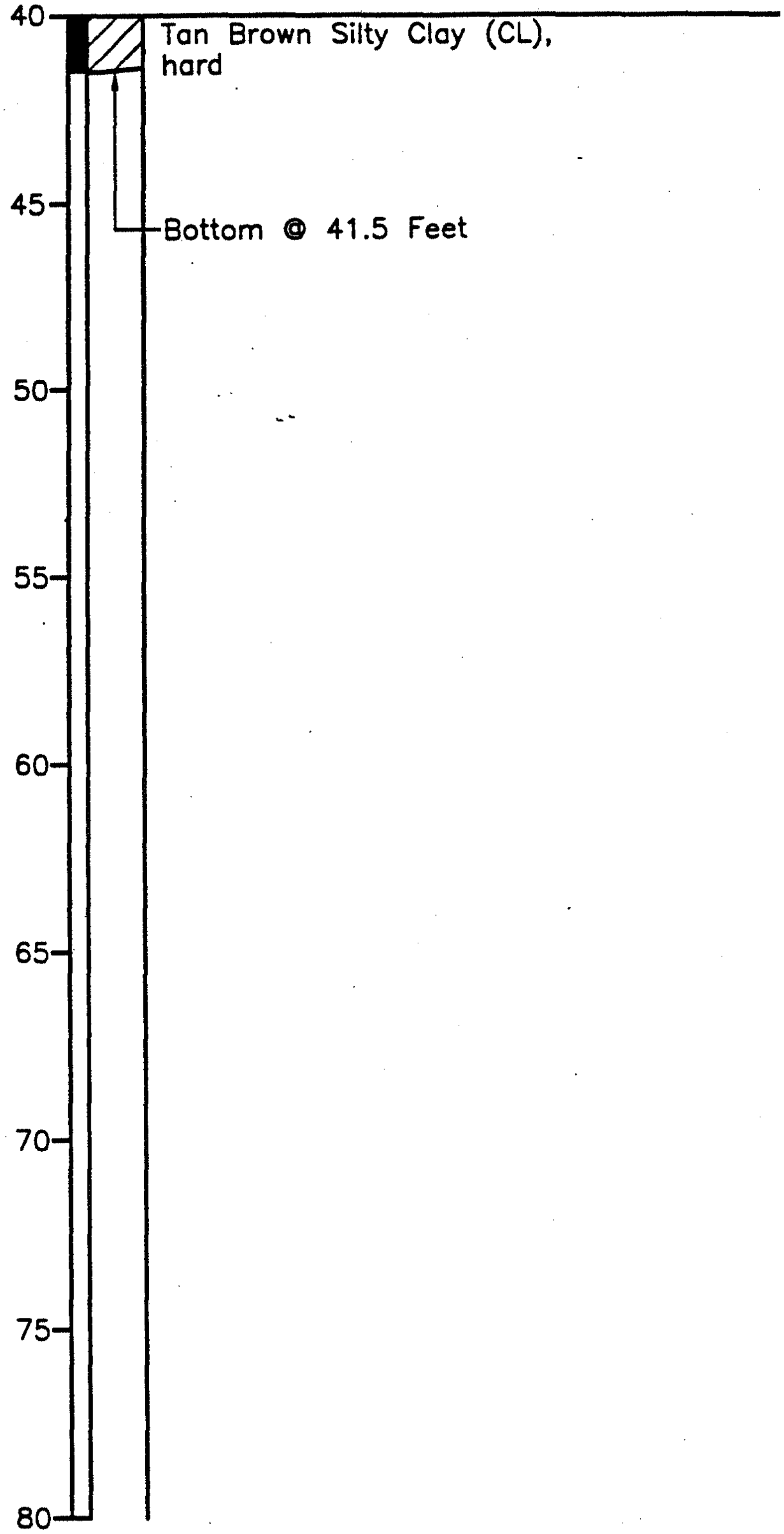
Milpitas, California

Drawn	Job Number	Approved	Date	Revised	Date
R. AGREDA	401801	M. KHAN	01/20/98	R. AGREDA	06/15/9

FILE: G:\DWGS\SDSKPROJ\4018_010\SHEETS\BERB-12A.DWG

(Continuation of Log)

Laboratory Tests	Blows/foot	Moisture Content %	Dry Density (psf)	Depth (ft)	Sample
	32*			40	



Tan Brown Silty Clay (CL), hard

Bottom @ 41.5 Feet

Santa Clara Valley Water District

LOG OF BORING B-12

Berryessa Creek Levee
Milpitas, California

PLATE

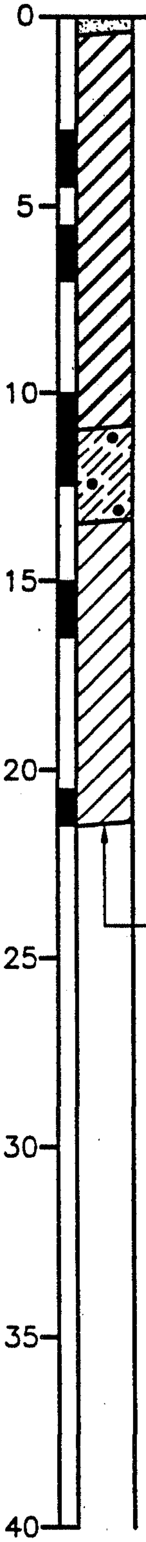
Drawn	Job Number	Approved	Date	Revised	Date
R. AGREDA	401801	M. KHAN	01/20/98	R. AGREDA	06/15/

FILE: G:\DWGS\SDSKPROJ\4018_010\SHEETS\BERB-12B.DWG

Equipment Rotary Wash

Top Elevation 20.06 Feet **Date** 10/10/97

Laboratory Tests	Blows/foot	Moisture Content %	Dry Density (psf)
UC 1554	11*	30	89
	16*		
	Push		
	11*		
UC 1361	22*	16	115



8" Aggregate Base

Dark Brown Fat Clay (CH), stiff to very stiff (fill)

Brown Clayey Sand (SC)

Brown Sandy Clay (CL), stiff to very stiff

Bottom @ 21.5 Feet

Santa Clara Valley Water District

LOG OF BORING B-13

Berryessa Creek Levee

Milpitas, California

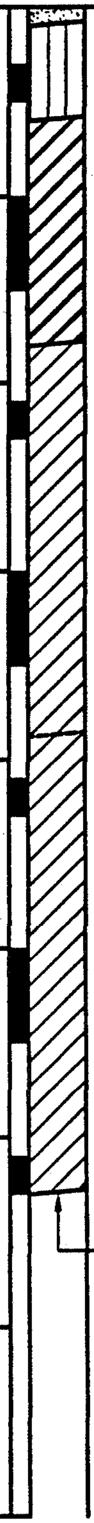
PLATE

Drawn	Job Number	Approved	Date	Revised	Date
R. AGREDA	401801	M. KHAN	01/20/98	R. AGREDA	06/15/98

FILE: G:\DWGS\SDSKPROJ\4018_010\SHEETS\BERB-13A.DWG

Equipment Rotary Wash

Top Elevation 22.54 Feet **Date** 10/16/97



Laboratory Tests	Blows/foot	Moisture Content %	Dry Density (psf)	Depth (ft)	
				0	6" Aggregate Base
					Brown and White Sandy Silt (ML), very stiff (fill)
	31*				
					Dark Brown Fat Clay (CH), stiff (fill)
				5	
LL=67, PI=41 CU 1640	Push	25	86		
					Brown Silty Clay (CL), stiff
				10	
	14*				
				15	
TxUU 565(1000)	Push	20	110		
					Brown Sandy Clay (CL), stiff to very stiff
				20	
	14*				
				25	
	Push				
				30	
	20*				
					Bottom @ 31.5 Feet
				35	
				40	

Santa Clara Valley Water District

LOG OF BORING B-14

Berryessa Creek Levee

Milpitas, California

PLATE

Drawn	Job Number	Approved	Date	Revised	Date
R. AGREDA	401801	M. KHAN	01/20/98	R. AGREDA	06/15/9

FILE: G:\DWGS\SDSKPROJ\4018_010\SHEETS\BERB-14A.DWG

APPENDIX B

Laboratory Test Results

LABORATORY CLASSIFICATION _ _ _ _ _ _ _ _ _ _ _ _ _ BORING _ _ 8 _ SAMPLE _ _ _ _ DEPTH 3-4

FIELD DENSITY

BY......./../..

DETERMINATION	1	2
NUMBER OF RINGS		
WT OF RINGS + WET SOIL		
WT OF RINGS		
WT OF WET SOIL		
FIELD DENSITY		
DRY DENSITY		

DETERMINATION	1	2
DISH		
WT OF DISH + WET SOIL		
WT OF DISH + DRY SOIL		
WT OF MOISTURE		
WT OF DISH		
WT OF DRY SOIL		
FIELD MOISTURE CONTENT		

THIS IS AN 1/8-INCH THREAD

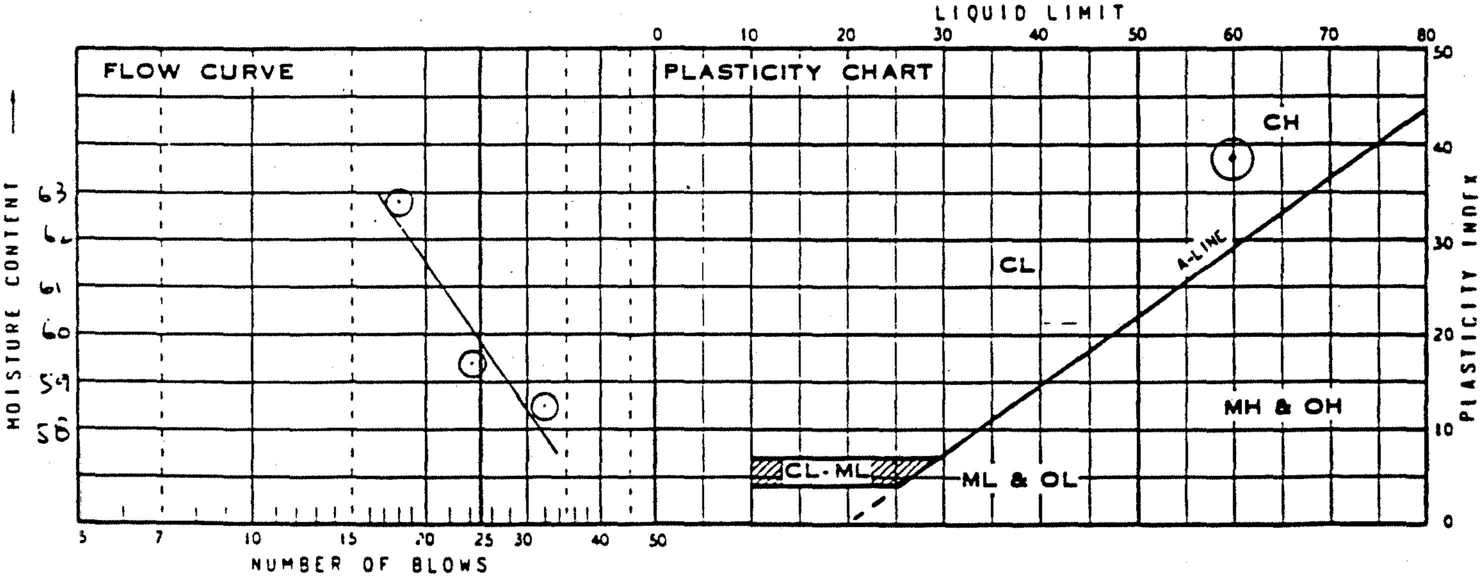
PLASTIC LIMIT

BY WL/MW 12/24/97

DETERMINATION	1	2	3	4	5	6
DISH	56 B					
WT OF DISH + WET SOIL	34.43					
WT OF DISH + DRY SOIL	31.21					
WT OF MOISTURE						
WT OF DISH	16.01					
WT OF DRY SOIL						
MOISTURE CONTENT	21.2					

LIQUID LIMIT

DETERMINATION	1	2	3	4	5	6
DISH	BW-1	24 C	24 C			
NUMBER OF BLOWS	32	24	18			
WT OF DISH + WET SOIL	29.80	30.13	28.40			
WT OF DISH + DRY SOIL	24.65	24.81	23.56			
WT OF MOISTURE						
WT OF DISH	15.84	15.85	15.85			
WT OF DRY SOIL						
MOISTURE CONTENT	58.5	59.4	62.8			



SUMMARY

DRY DENSITY	MOISTURE CONTENT	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	IDENTIFICATION	
		59.4	21.2	38.6	CH	

DAMES & MOORE

ATTERBERG LIMITS TEST DATA

FIELD CLASSIFICATION ______________

LABORATORY CLASSIFICATION ______________

JOB NO. ______________

CLIENT/OWNER BERRYESSA CREEK

LOCATION ______________

BORING B-9 SAMPLE ____ DEPTH 3.5-5

FIELD DENSITY BY ____/__/__

DETERMINATION	1	2
NUMBER OF RINGS		
WT OF RINGS + WET SOIL		
WT OF RINGS		
WT OF WET SOIL		
FIELD DENSITY		
DRY DENSITY		

DETERMINATION	1	2
DISH		
WT OF DISH + WET SOIL		
WT OF DISH + DRY SOIL		
WT OF MOISTURE		
WT OF DISH		
WT OF DRY SOIL		
FIELD MOISTURE CONTENT		

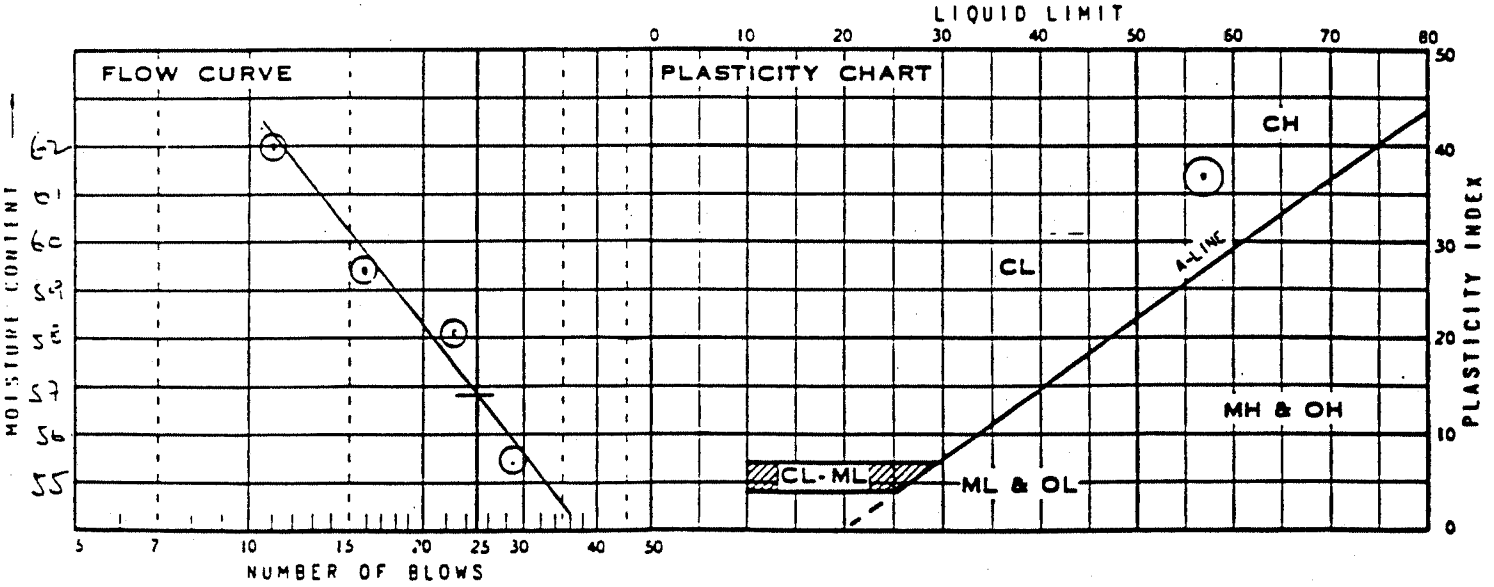
THIS IS AN 1/8-INCH THREAD

PLASTIC LIMIT BY WL 12/28/97

DETERMINATION	1	2	3	4	5	6
DISH	54B					
WT OF DISH + WET SOIL	32.23					
WT OF DISH + DRY SOIL	29.52					
WT OF MOISTURE						
WT OF DISH	15.79					
WT OF DRY SOIL						
MOISTURE CONTENT	19.7					

LIQUID LIMIT

DETERMINATION	1	2	3	4	5	6
DISH	67B	BW 10	34 B	12C	79B	
NUMBER OF BLOWS		11	16	23	29	
WT OF DISH + WET SOIL		31.10	29.01	26.98	26.56	
WT OF DISH + DRY SOIL		25.19	23.93	22.84	22.58	
WT OF MOISTURE						
WT OF DISH	15.25	15.66	15.38	15.73	15.39	
WT OF DRY SOIL						
MOISTURE CONTENT		62.0	59.4	58.~	55.4	



SUMMARY

DRY DENSITY	MOISTURE CONTENT	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	IDENTIFICATION	
		56.8	19.7	37.1	CH	

ERBERG LIMITS TEST DATA

FIELD CLASSIFICATION _______________

ABORATORY CLASSIFICATION _______________

JOB NO. [illegible]
CLIENT/OWNER S.C.V.W.D.
LOCATION BERRYESSA [illegible]
BORING B9 SAMPLE 7 DEPTH 15 ft.

FIELD DENSITY BY ____/__/__

DETERMINATION	1	2
NUMBER OF RINGS		
WT OF RINGS + WET SOIL		
WT OF RINGS		
WT OF WET SOIL		
FIELD DENSITY		
DRY DENSITY		

DETERMINATION	1	2
DISH		
WT OF DISH + WET SOIL		
WT OF DISH + DRY SOIL		
WT OF MOISTURE		
WT OF DISH		
WT OF DRY SOIL		
FIELD MOISTURE CONTENT		

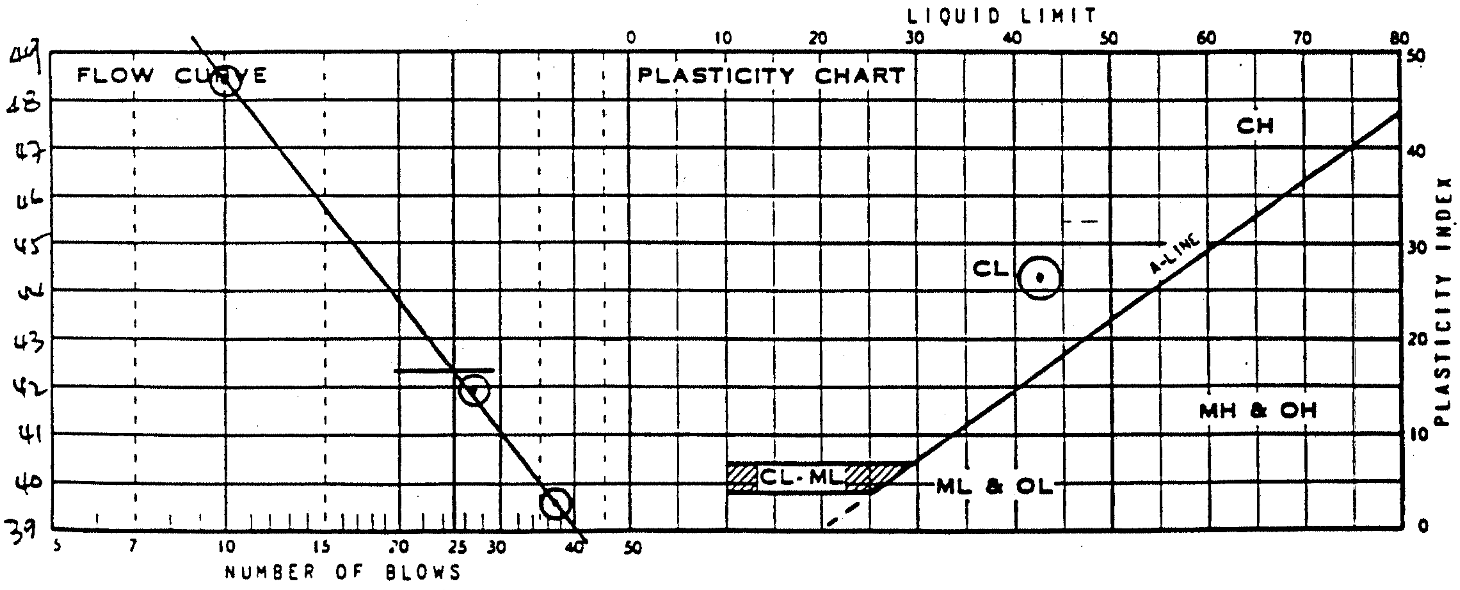
THIS IS AN 1/8-INCH THREAD

PLASTIC LIMIT BY WL 12 10 97

DETERMINATION	1	2	3	4	5	6
DISH	9B					
WT OF DISH + WET SOIL	30.37					
WT OF DISH + DRY SOIL	28.35					
WT OF MOISTURE						
WT OF DISH	15.56					
WT OF DRY SOIL						
MOISTURE CONTENT	15.8					

LIQUID LIMIT

DETERMINATION	1	2	3	4	5	6
DISH	79B	81B	29C			
NUMBER OF BLOWS	10	37	27			
WT OF DISH + WET SOIL	29.72	26.95	29.19			
WT OF DISH + DRY SOIL	25.04	23.73	25.25			
WT OF MOISTURE						
WT OF DISH	15.39	15.60	15.85			
WT OF DRY SOIL						
MOISTURE CONTENT	48.5	39.6	41.9			



SUMMARY

DRY DENSITY	MOISTURE CONTENT	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	IDENTIFICATION	TEST ON MAT'L
		42.3	15.8	26.5	CL	PASSING # 40 SIEVE

LOCATION ____________

LABORATORY CLASSIFICATION ____________

BORING B-10 SAMPLE ____ DEPTH 5-7.5

FIELD DENSITY BY ____ __/__/__

DETERMINATION	1	2
NUMBER OF RINGS		
WT OF RINGS + WET SOIL		
WT OF RINGS		
WT OF WET SOIL		
FIELD DENSITY		
DRY DENSITY		

DETERMINATION	1	2
DISH		
WT OF DISH + WET SOIL		
WT OF DISH + DRY SOIL		
WT OF MOISTURE		
WT OF DISH		
WT OF DRY SOIL		
FIELD MOISTURE CONTENT		

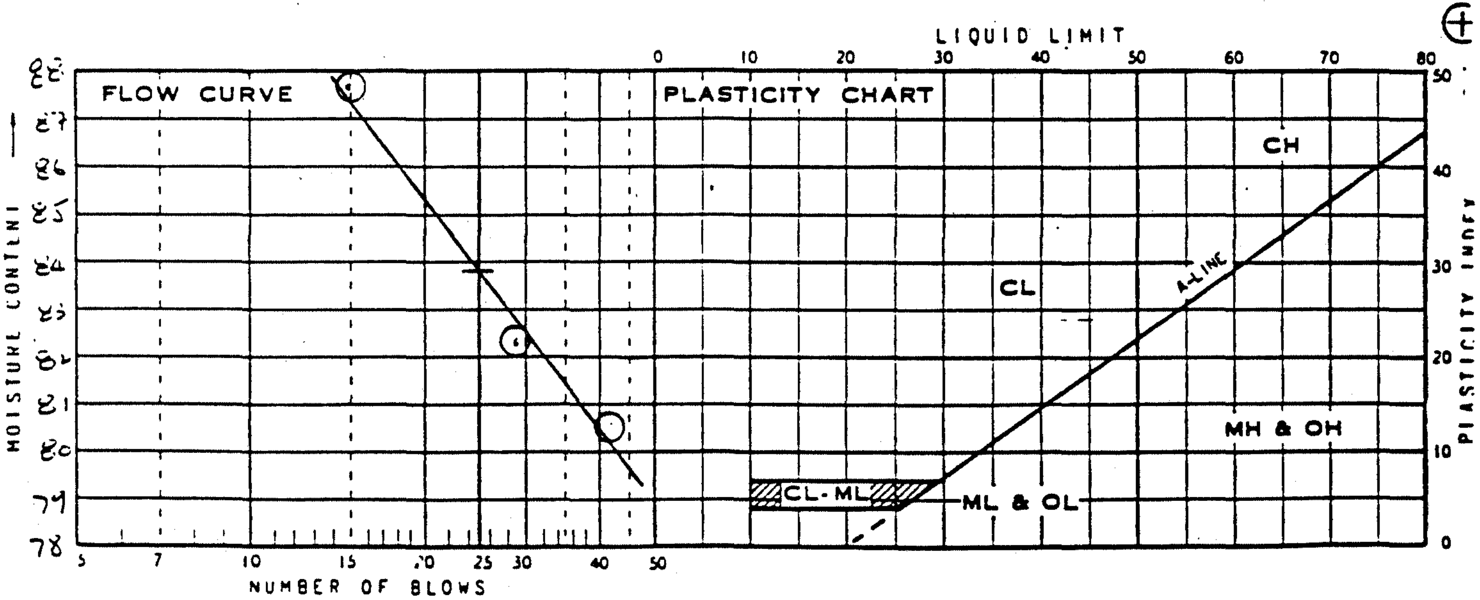
THIS IS AN 1/8-INCH THREAD

PLASTIC LIMIT BY WL 12/29/97

DETERMINATION	1	2	3	4	5	6
DISH	BW 10					
WT OF DISH + WET SOIL	28.97					
WT OF DISH + DRY SOIL	26.03					
WT OF MOISTURE						
WT OF DISH	15.67					
WT OF DRY SOIL						
MOISTURE CONTENT	28.4					

LIQUID LIMIT

DETERMINATION	1	2	3	4	5	6
DISH	~~1E~~	3C	26B	81B		
NUMBER OF BLOWS	~~41~~	42	29	15		
WT OF DISH + WET SOIL	~~28.47~~	26.98	27.04	27.76		
WT OF DISH + DRY SOIL	~~22.70~~	21.90	21.85	22.08		
WT OF MOISTURE						
WT OF DISH	~~15.35~~	15.60	15.54	15.60		
WT OF DRY SOIL						
MOISTURE CONTENT	~~78.5~~	80.6	82.3	87.7		



SUMMARY

DRY DENSITY	MOISTURE CONTENT	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	IDENTIFICATION	
		83.8	28.4	55.4	CH	

DAMES & MOORE

'ERBERG LIMITS TEST DATA

FIELD CLASSIFICATION ______________

ABORATORY CLASSIFICATION (CH)

JOB NO. [illegible]
CLIENT/OWNER BERRYESSA CREEK
LOCATION
BORING B 11 SAMPLE ____ DEPTH 3-5

FIELD DENSITY BY ____/__/__

DETERMINATION	1	2
NUMBER OF RINGS		
WT OF RINGS + WET SOIL		
WT OF RINGS		
WT OF WET SOIL		
FIELD DENSITY		
DRY DENSITY		

DETERMINATION	1	2
DISH		
WT OF DISH + WET SOIL		
WT OF DISH + DRY SOIL		
WT OF MOISTURE		
WT OF DISH		
WT OF DRY SOIL		
FIELD MOISTURE CONTENT		

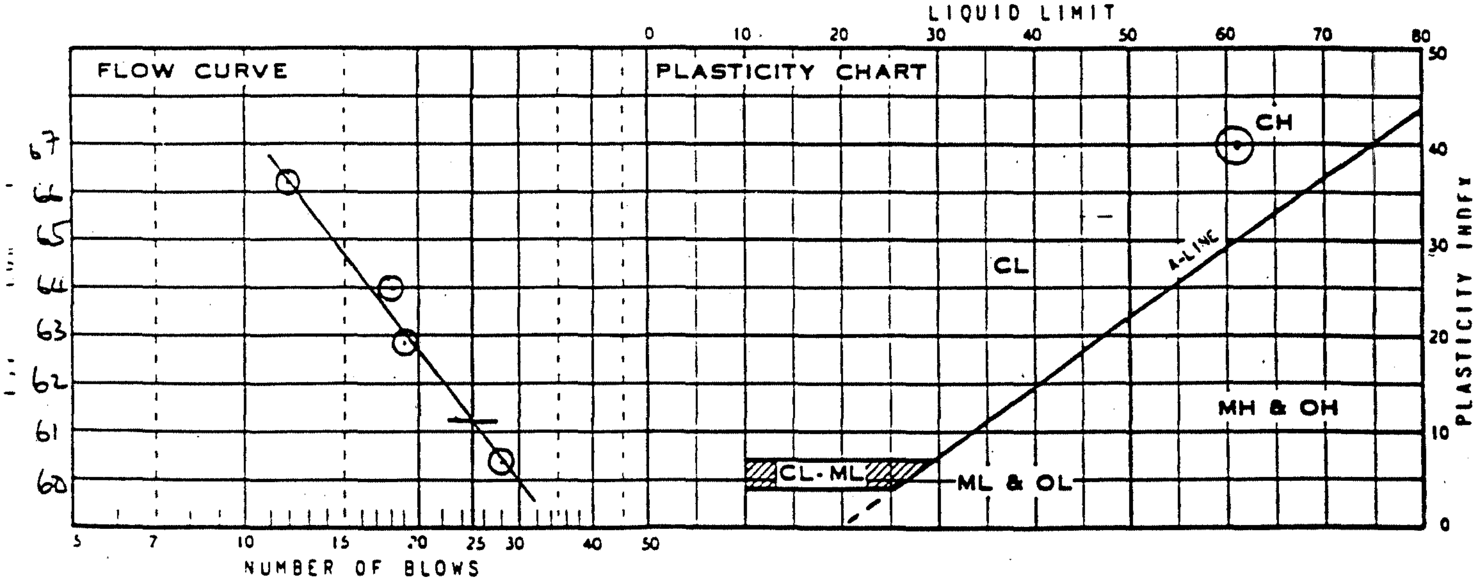
THIS IS AN 1/8-INCH THREAD

PLASTIC LIMIT BY WL 12/16/97

DETERMINATION	1	2	3	4	5	6
DISH	5C					
WT OF DISH + WET SOIL	28.43					
WT OF DISH + DRY SOIL	26.22					
WT OF MOISTURE						
WT OF DISH	15.79					
WT OF DRY SOIL						
MOISTURE CONTENT	21.2					

LIQUID LIMIT

DETERMINATION	1	2	3	4	5	6
DISH	BW-12	18C	55B	BW-3		
NUMBER OF BLOWS	12	18	19	28		
WT OF DISH + WET SOIL	22.52	27.75	27.36	26.06		
WT OF DISH + DRY SOIL	17.97	23.12	22.98	22.18		
WT OF MOISTURE						
WT OF DISH	11.10	15.88	16.00	15.76		
WT OF DRY SOIL						
MOISTURE CONTENT	66.2	64.0	62.8	60.4		



SUMMARY

DRY DENSITY	MOISTURE CONTENT	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	IDENTIFICATION	
		61.2	21.2	40.0	CH	

BERG LIMITS TEST DATA

JOB NO.

CLIENT/OWNER BERRYESSA CREEK

LOCATION

BORING B 12 SAMPLE 5.5 DEPTH 5.5'

CLASSIFICATION

RATORY CLASSIFICATION (CH) DK BROWN FAT CLAY

FIELD DENSITY BY ___/___/___

DETERMINATION	1	2
NUMBER OF RINGS		
WT OF RINGS + WET SOIL		
WT OF RINGS		
WT OF WET SOIL		
FIELD DENSITY		
DRY DENSITY		

DETERMINATION	1	2
DISH		
WT OF DISH + WET SOIL		
WT OF DISH + DRY SOIL		
WT OF MOISTURE		
WT OF DISH		
WT OF DRY SOIL		
FIELD MOISTURE CONTENT		

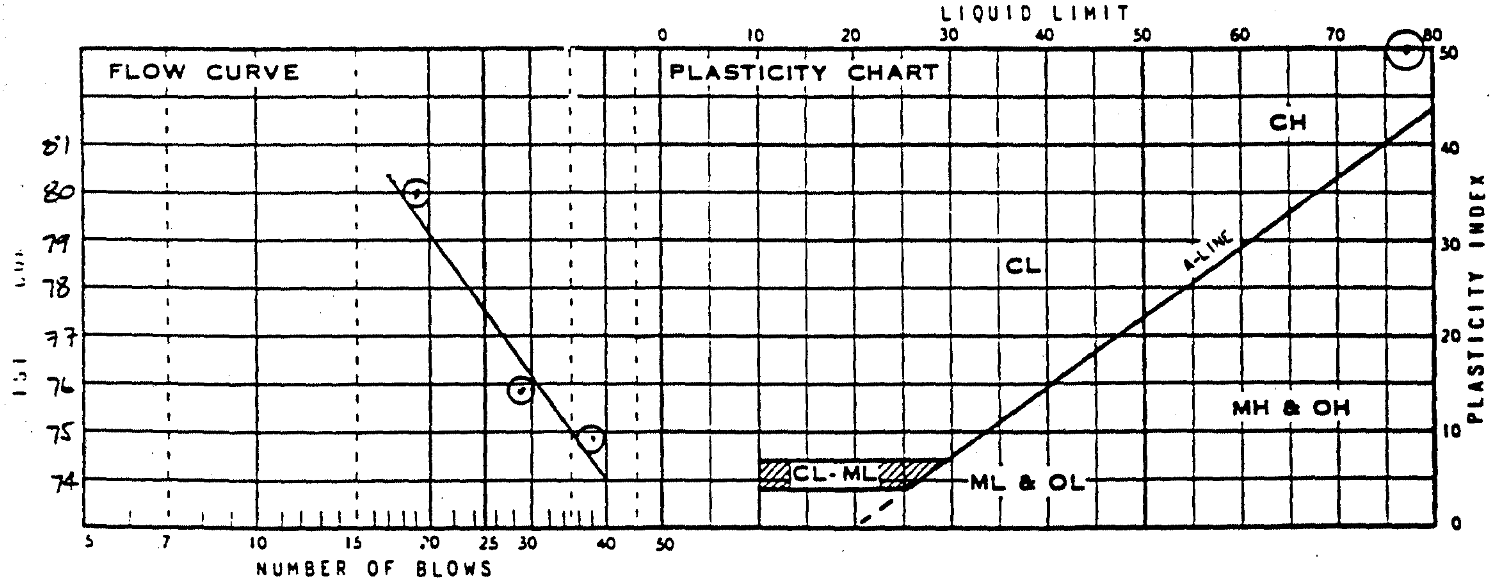
THIS IS AN 1/8-INCH THREAD

PLASTIC LIMIT BY WL/MW 12/16/97

DETERMINATION	1	2	3	4	5	6
DISH	26B					
WT OF DISH + WET SOIL	27.85					
WT OF DISH + DRY SOIL	25.19					
WT OF MOISTURE						
WT OF DISH	15.55					
WT OF DRY SOIL						
MOISTURE CONTENT	27.6					

LIQUID LIMIT

DETERMINATION	1	2	3	4	5	6
DISH	54B	22C	BW 10			
NUMBER OF BLOWS	38	29	19			
WT OF DISH + WET SOIL	25.61	24.60	25.60			
WT OF DISH + DRY SOIL	21.40	20.77	21.19			
WT OF MOISTURE						
WT OF DISH	15.78	15.72	15.68			
WT OF DRY SOIL						
MOISTURE CONTENT	74.9	75.8	80.0			



SUMMARY

DRY DENSITY	MOISTURE CONTENT	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	IDENTIFICATION	
		77.6	27.6	50.0	CH	

FIELD CLASSIFICATION ________________

LABORATORY CLASSIFICATION ________________

LOCATION [illegible]

BORING BJ4 SAMPLE ____ DEPTH 5-7.5'

FIELD DENSITY BY ____/__/__

DETERMINATION	1	2
NUMBER OF RINGS		
WT OF RINGS + WET SOIL		
WT OF RINGS		
WT OF WET SOIL		
FIELD DENSITY		
DRY DENSITY		

THIS IS AN 1/8-INCH THREAD

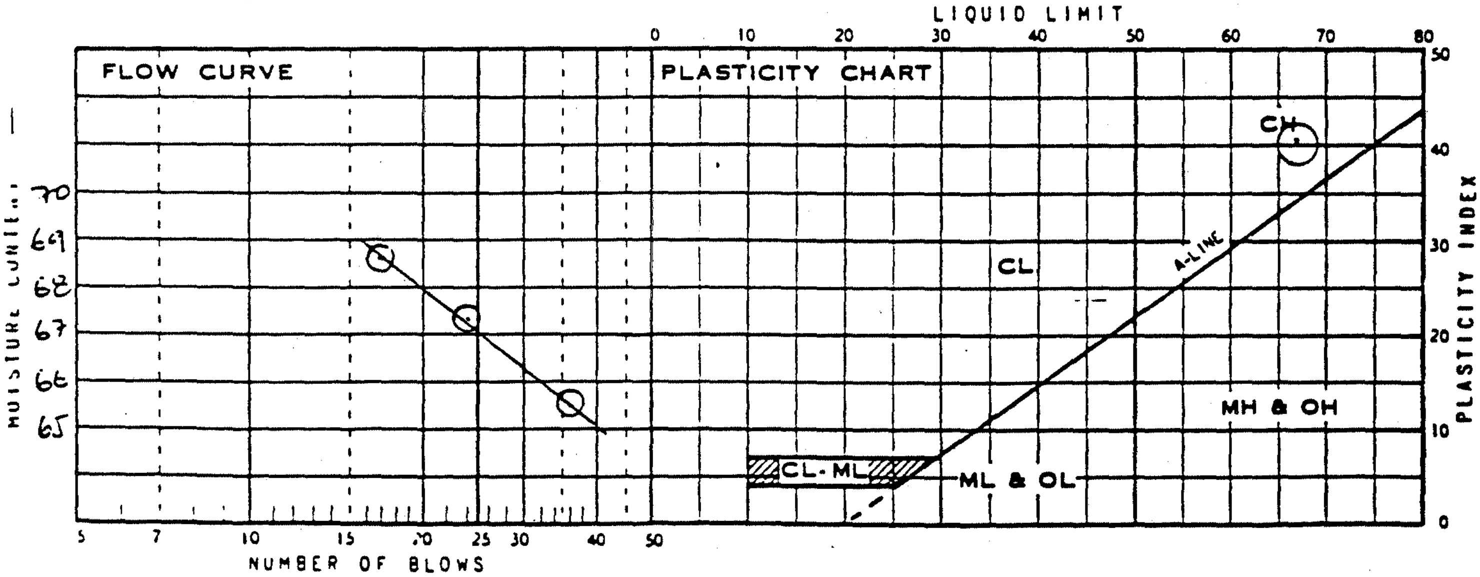
DETERMINATION	1	2
DISH		
WT OF DISH + WET SOIL		
WT OF DISH + DRY SOIL		
WT OF MOISTURE		
WT OF DISH		
WT OF DRY SOIL		
FIELD MOISTURE CONTENT		

PLASTIC LIMIT BY MW 12.29.97

DETERMINATION	1	2	3	4	5	6
DISH	29 C					
WT OF DISH + WET SOIL	31.46					
WT OF DISH + DRY SOIL	28.20					
WT OF MOISTURE						
WT OF DISH	15.86					
WT OF DRY SOIL						
MOISTURE CONTENT	26.4					

LIQUID LIMIT

DETERMINATION	1	2	3	4	5	6
DISH	7C	18C	BW 1			
NUMBER OF BLOWS	36	24	17			
WT OF DISH + WET SOIL	26.47	29.01	28.75			
WT OF DISH + DRY SOIL	22.23	23.73	23.50			
WT OF MOISTURE						
WT OF DISH	15.77	15.88	15.86			
WT OF DRY SOIL						
MOISTURE CONTENT	65.6	67.3	68.7			



SUMMARY

DRY DENSITY	MOISTURE CONTENT	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	IDENTIFICATION	
		67.0	26.4	40.6	CH	

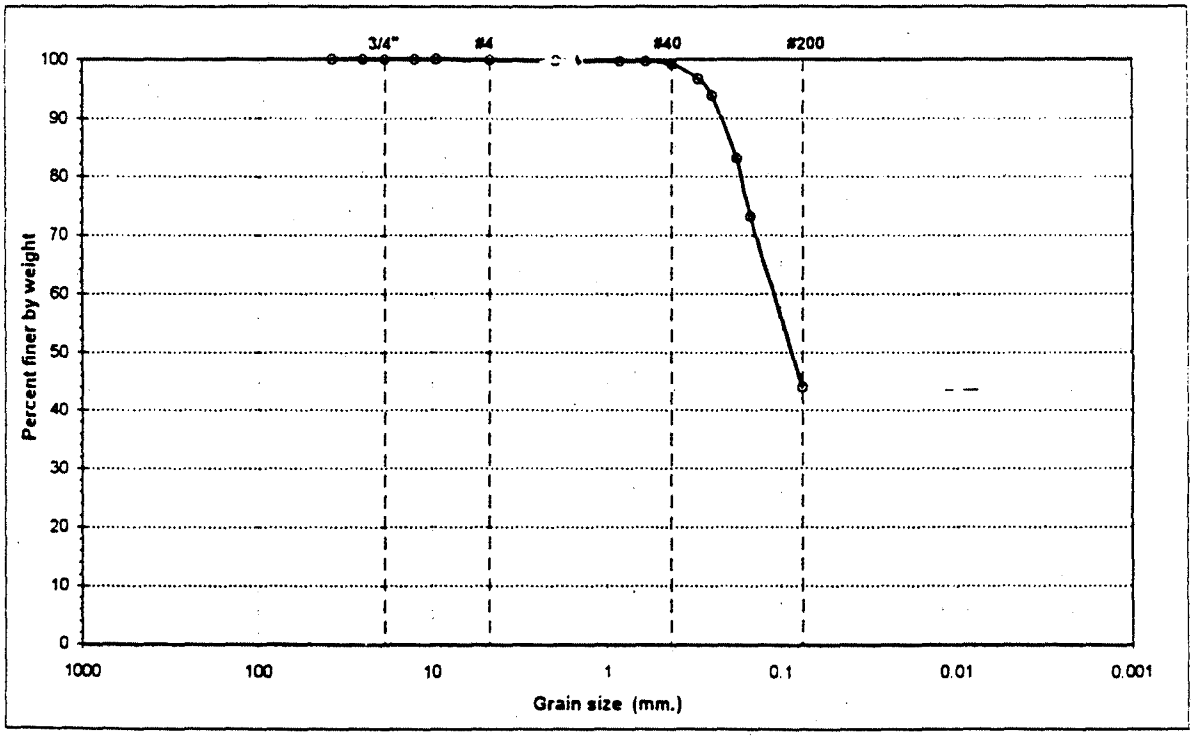
DAMES & MOORE

GRAIN SIZE ANALYSIS

Job # : 00481-005-003
Client : S.C.V.W.D.
Project : Berryessa Creek
Sample ID : B - 8 # 4 @ 30-31.5 ft.
Date tested : 12/8/97
Tested by : WL
Soil : SM

Dish # 921
Wt of Dry Soil + Dish (gm) = 724.7
Dish Wt. (gm) = 110.7
Net Wt. (gm) = 614.0

Sieve Opening (mm)	Sieve Size	Cumulative Wt. Retained (gm)	Cumulative % Passing (%)	Correction Factor	Corrected Cumulative % Passing
76.100	3 in.	0.0	100.0	1.00	100.0
50.800	2 in.	0.0	100.0	1.00	100.0
38.100	1.5 in.	0.0	100.0	1.00	100.0
25.400	1 in.	0.0	100.0	1.00	100.0
19.000	3/4 in.	0.0	100.0	1.00	100.0
12.700	1/2 in.	0.0	100.0	1.00	100.0
9.510	3/8 in.	0.0	100.0	1.00	100.0
4.760	#4	0.8	99.9	1.00	99.9
2.000	#10	1.5	99.8	1.00	99.8
0.850	#20	2.0	99.7	1.00	99.7
0.600	#30	2.3	99.6	1.00	99.6
0.425	#40	4.3	99.3	1.00	99.3
0.300	#50	20.2	96.7	1.00	96.7
0.250	#60	37.9	93.8	1.00	93.8
0.180	#80	103.6	83.1	1.00	83.1
0.150	#100	164.7	73.2	1.00	73.2
0.075	#200	344.0	44.0	1.00	44.0

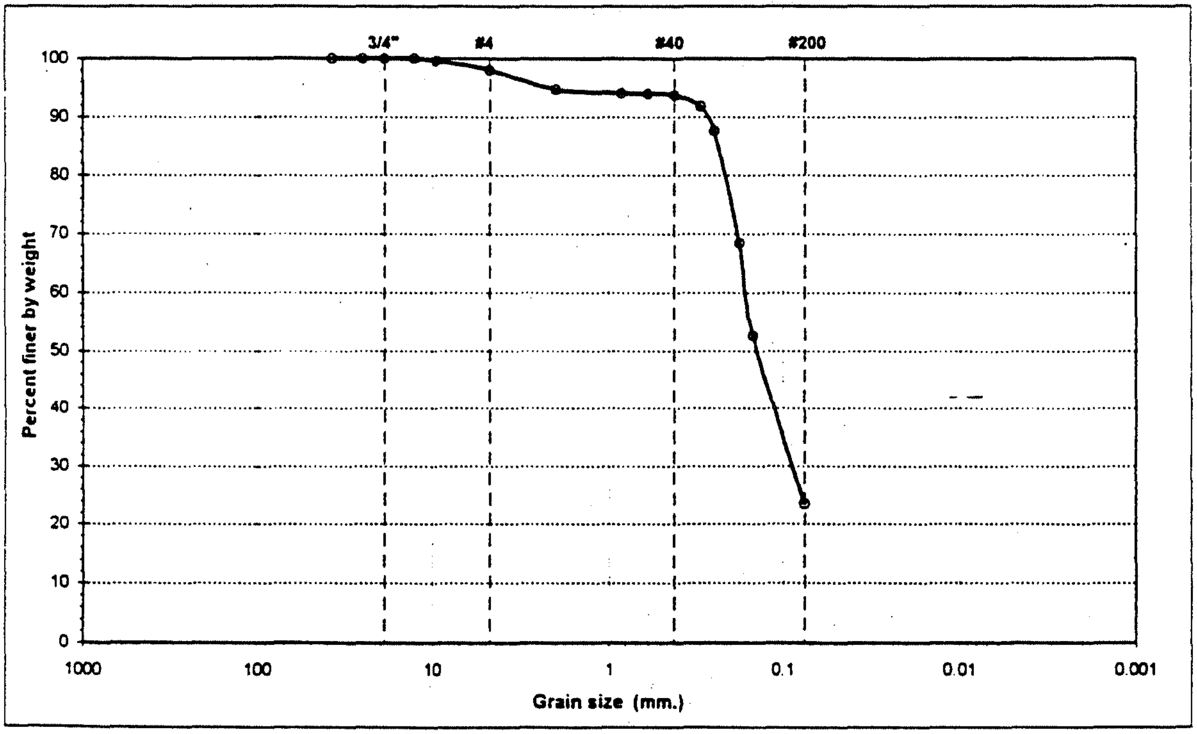


GRAIN SIZE ANALYSIS

Job # : 00481-005-003
Client : S.C.V.W.D.
Project : Berryessa Creek
Sample ID : B - 8 # 5 @ 35-36.5 ft.
Date tested : 12/8/97
Tested by : WL
Soil : SM

Dish # XL
Wt of Dry Soil + Dish (gm) = 790.1
Dish Wt. (gm) = 109.0
Net Wt. (gm) = 681.1

Sieve Opening (mm)	Sieve Size	Cumulative Wt. Retained (gm)	Cumulative % Passing (%)	Correction Factor	Corrected Cumulative % Passing
76.100	3 in.	0.0	100.0	1.00	100.0
50.800	2 in.	0.0	100.0	1.00	100.0
38.100	1.5 in.	0.0	100.0	1.00	100.0
25.400	1 in.	0.0	100.0	1.00	100.0
19.000	3/4 in.	0.0	100.0	1.00	100.0
12.700	1/2 in.	0.0	100.0	1.00	100.0
9.510	3/8 in.	2.8	99.6	1.00	99.6
4.760	#4	12.8	98.1	1.00	98.1
2.000	#10	36.2	94.7	1.00	94.7
0.850	#20	40.6	94.0	1.00	94.0
0.600	#30	41.0	94.0	1.00	94.0
0.425	#40	42.3	93.8	1.00	93.8
0.300	#50	55.8	91.8	1.00	91.8
0.250	#60	84.0	87.7	1.00	87.7
0.180	#80	215.2	68.4	1.00	68.4
0.150	#100	322.9	52.6	1.00	52.6
0.075	#200	520.8	23.5	1.00	23.5

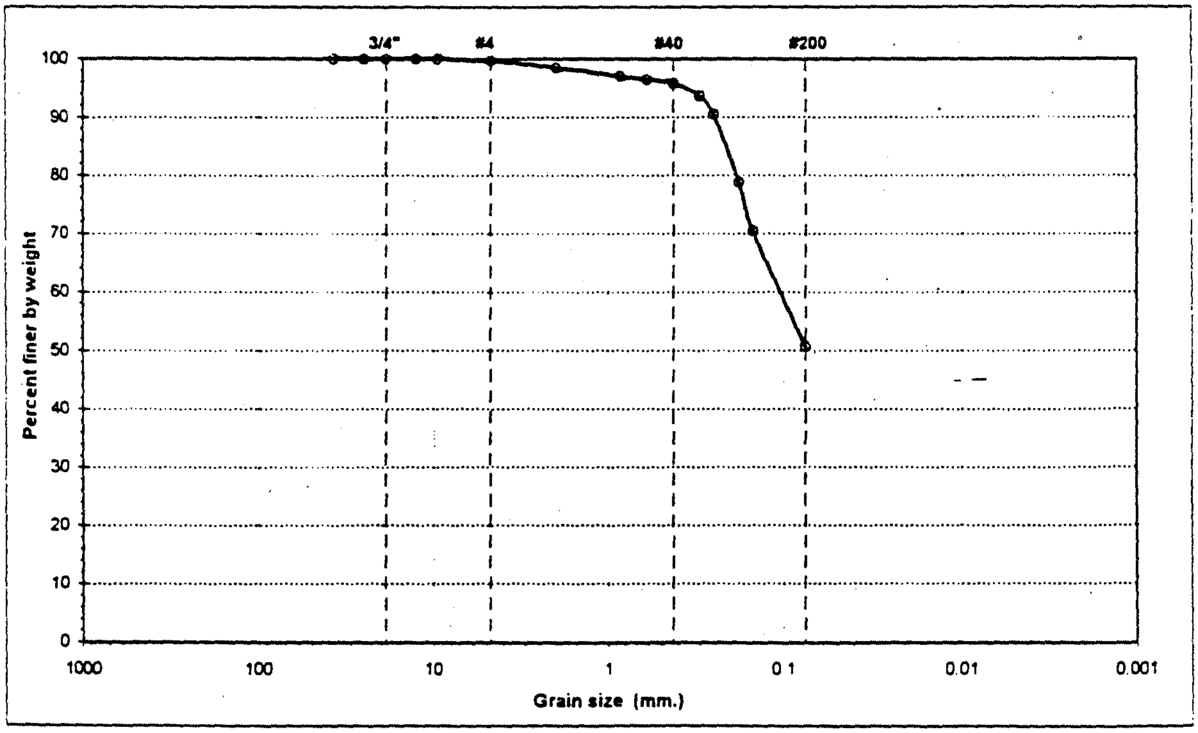


GRAIN SIZE ANALYSIS

Job # : 00481-005-003
Client : S.C.V.W.D.
Project : Berryessa Creek
Sample ID : B - 9 # 5 @ 20-21.5 ft.
Date tested : 12/8/97
Tested by : WL
Soil : SC/CL

Dish # DD
Wt of Dry Soil + Dish (gm) = 839.8
Dish Wt. (gm) = 112.8
Net Wt. (gm) = 727.0

Sieve Opening (mm)	Sieve Size	Cumulative Wt. Retained (gm)	Cumulative % Passing (%)	Correction Factor	Corrected Cumulative % Passing
76.100	3 in.	0.0	100.0	1.00	100.0
50.800	2 in.	0.0	100.0	1.00	100.0
38.100	1.5 in.	0.0	100.0	1.00	100.0
25.400	1 in.	0.0	100.0	1.00	100.0
19.000	3/4 in.	0.0	100.0	1.00	100.0
12.700	1/2 in.	0.0	100.0	1.00	100.0
9.510	3/8 in.	0.0	100.0	1.00	100.0
4.760	#4	2.6	99.6	1.00	99.6
2.000	#10	11.3	98.4	1.00	98.4
0.850	#20	21.9	97.0	1.00	97.0
0.600	#30	25.6	96.5	1.00	96.5
0.425	#40	30.3	95.8	1.00	95.8
0.300	#50	46.4	93.6	1.00	93.6
0.250	#60	68.9	90.5	1.00	90.5
0.180	#80	154.1	78.8	1.00	78.8
0.150	#100	214.2	70.5	1.00	70.5
0.075	#200	358.3	50.7	1.00	50.7

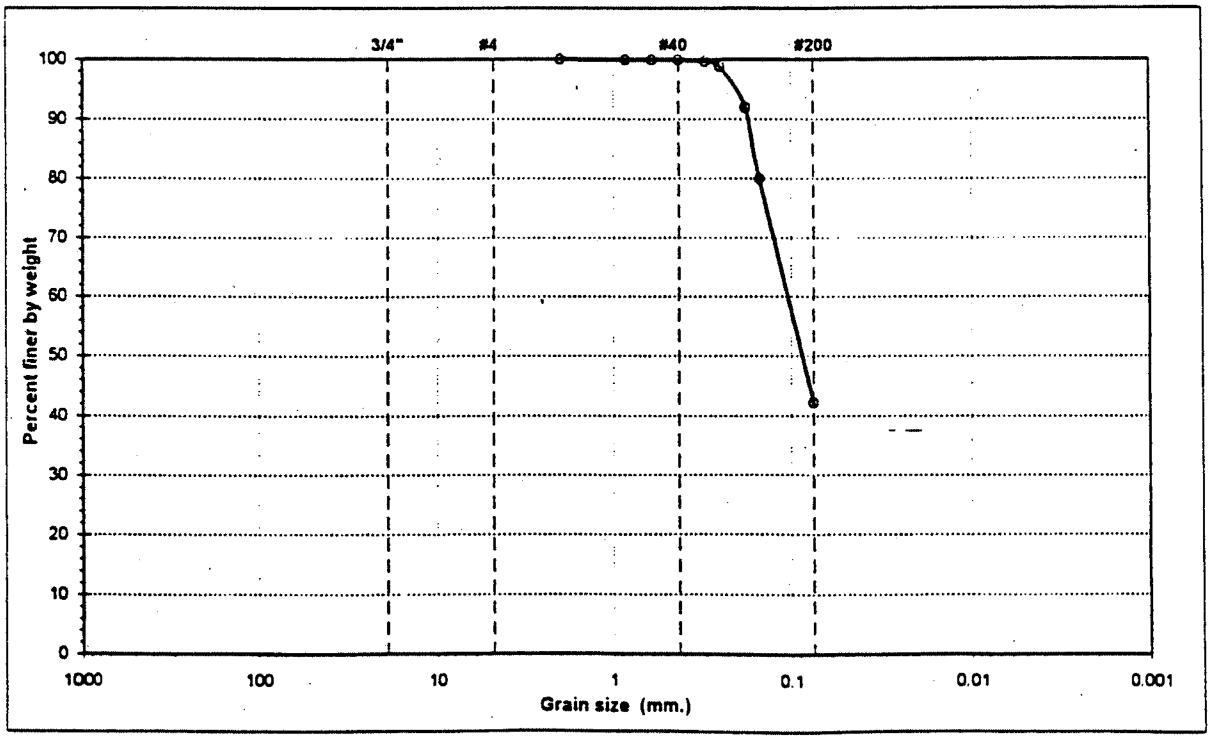


GRAIN SIZE ANALYSIS

Job # :	00481-005-003
Client :	S.C.V.W.D.
Project :	Berryessa Creek
Sample ID :	B - 9 @ 26 ft.
Date tested :	1/19/98
Tested by :	WL
Soil :	SM

Dish # 10
Wt of Dry Soil + Dish (gm) = 626.7
Dish Wt. (gm) = 296.7
Net Wt. (gm) = 330.0

Sieve Opening (mm)	Sieve Size	Cumulative Wt. Retained (gm)	Cumulative % Passing (%)	Correction Factor	Corrected Cumulative % Passing
76.100	3 in.				
50.800	2 in.				
38.100	1.5 in.				
25.400	1 in.				
19.000	3/4 in.				
12.700	1/2 in.				
9.510	3/8 in.				
4.760	#4				
2.000	#10	0.0	100.0	1.00	100.0
0.850	#20	0.3	99.9	1.00	99.9
0.600	#30	0.4	99.9	1.00	99.9
0.425	#40	0.4	99.9	1.00	99.9
0.300	#50	1.0	99.7	1.00	99.7
0.250	#60	3.8	98.9	1.00	98.9
0.180	#80	26.1	92.1	1.00	92.1
0.150	#100	66.0	80.0	1.00	80.0
0.075	#200	190.9	42.2	1.00	42.2



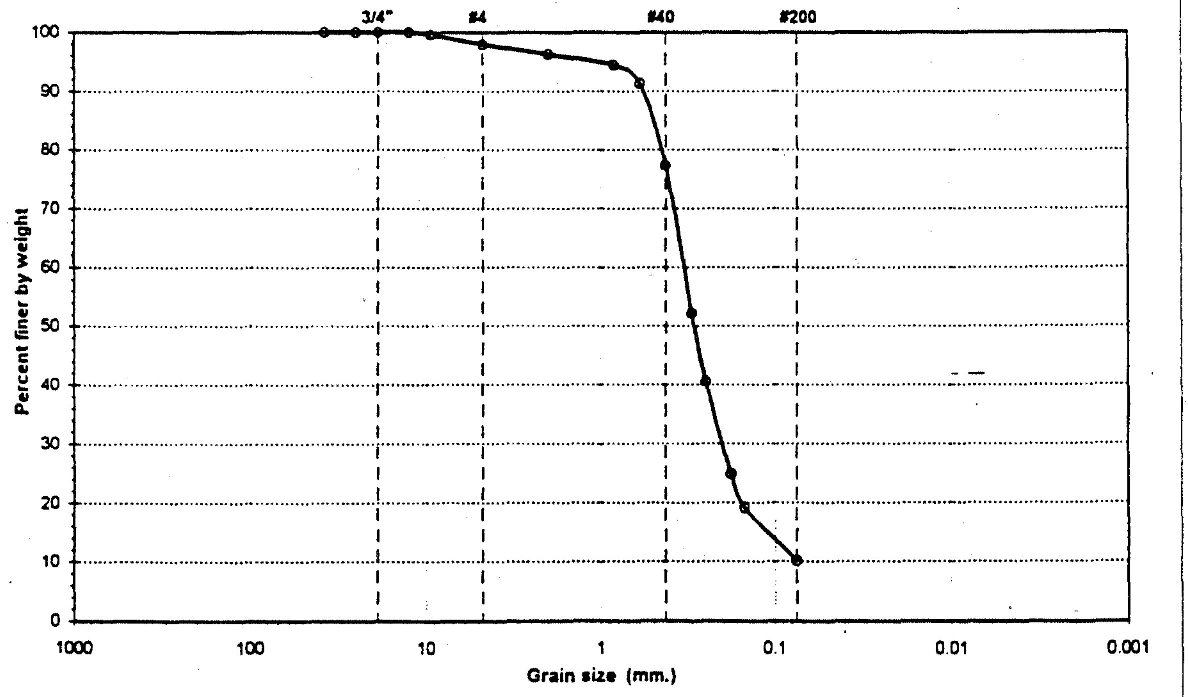
Dames & Moore

GRAIN SIZE ANALYSIS

Job # : 00481-005-003
Client : S.C.V.W.D.
Project : Berryessa Creek
Sample ID : B - 9 # 7 @ 30-31.5 ft.
Date tested : 12/8/97
Tested by : WL
Soil : SP/SM

Dish # 939
Wt of Dry Soil + Dish (gm) = 620.7
Dish Wt. (gm) = 78.0
Net Wt. (gm) = 542.7

Sieve Opening (mm)	Sieve Size	Cumulative Wt. Retained (gm)	Cumulative % Passing (%)	Correction Factor	Corrected Cumulative % Passing
76.100	3 in.	0.0	100.0	1.00	100.0
50.800	2 in.	0.0	100.0	1.00	100.0
38.100	1.5 in.	0.0	100.0	1.00	100.0
25.400	1 in.	0.0	100.0	1.00	100.0
19.000	3/4 in.	0.0	100.0	1.00	100.0
12.700	1/2 in.	0.0	100.0	1.00	100.0
9.510	3/8 in.	2.5	99.5	1.00	99.5
4.760	#4	10.8	98.0	1.00	98.0
2.000	#10	20.1	96.3	1.00	96.3
0.850	#20	30.2	94.4	1.00	94.4
0.600	#30	46.9	91.4	1.00	91.4
0.425	#40	122.7	77.4	1.00	77.4
0.300	#50	259.3	52.2	1.00	52.2
0.250	#60	322.6	40.6	1.00	40.6
0.180	#80	407.7	24.9	1.00	24.9
0.150	#100	438.9	19.1	1.00	19.1
0.075	#200	487.9	10.1	1.00	10.1



UNCONFINED COMPRESSION TEST

Client : S.C.V.W.D.
Project : Berryessa Creek
Job # : 00481-005-003
Boring # : B-10
Sample # : -
Depth (ft) : 5-7.5
Date tested : 12/28/97
Soil : (CH) Dark brown fat clay

Test Report:

Strain at failure, %	5.9
Unconfined compressive strength,psf	3977.9
Shear strength,psf	1988.9

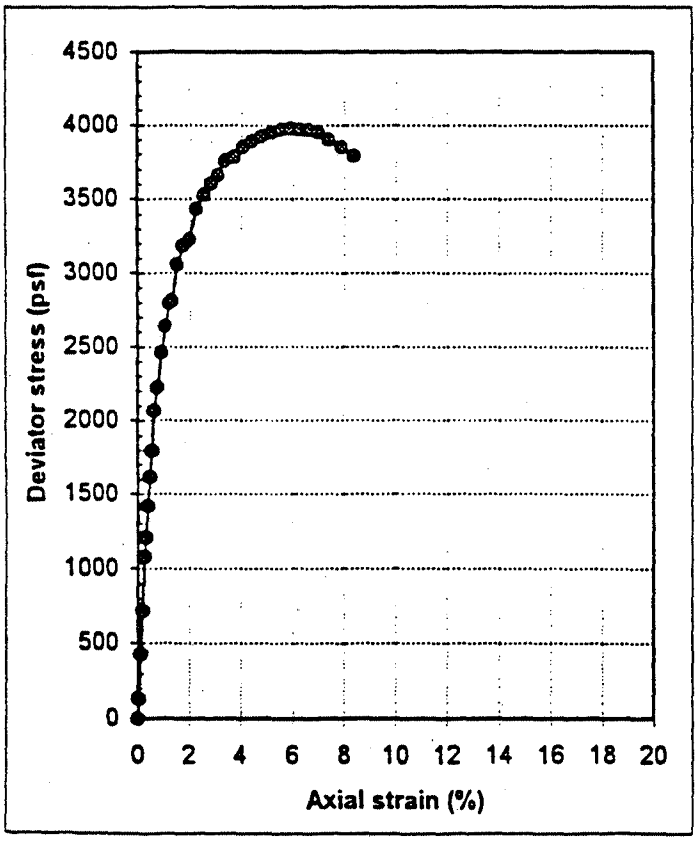
Specimen:

Total wt. = 1211.3 gms
Ht. = 5.97 in
Ave dia. = 2.875 in
Area = 6.494 sq.in
Volume = 635.4 c.c.
Moisture = 33.4 %
Total density = 119.0 pcf
Dry density = 89.2 pcf

Dial factor = 0.000300 in/unit
Load factor = 0.123859 lb/unit
Shearing rate = 0.75 %/min

Data Reduction:

Dial Read.	Load Read.	Axial Strain (%)	Deviator Stress (psf)
339	171	0.00	0.0
344	219	0.03	131.8
357	327	0.09	428.0
371	433	0.16	718.4
388	564	0.25	1076.6
399	611	0.30	1204.7
413	690	0.37	1420.0
427	762	0.44	1615.9
441	829	0.51	1797.8
458	928	0.60	2066.5
482	986	0.72	2222.2
510	1074	0.86	2458.6
539	1142	1.00	2639.9
568	1200	1.15	2793.5
595	1208	1.29	2811.3
635	1301	1.49	3057.2
676	1350	1.69	3183.1
731	1370	1.97	3228.0
787	1450	2.25	3433.5
844	1488	2.54	3525.2
900	1521	2.82	3603.1
952	1546	3.08	3660.0
1008	1586	3.36	3755.5
1075	1600	3.69	3779.5
1147	1631	4.06	3847.0
1219	1652	4.42	3887.6
1293	1671	4.79	3922.2
1365	1686	5.15	3946.4
1439	1701	5.52	3969.8
1511	1710	5.88	3977.9
1583	1713	6.25	3970.3
1656	1718	6.61	3967.6
1727	1717	6.97	3950.0
1809	1705	7.38	3901.9
1909	1693	7.88	3850.4
2007	1677	8.37	3789.6



UNCONFINED COMPRESSION TEST

Client : S.C.V.W.D.
Project : Berryessa Creek
Job # : 00481-005-003
Boring # : B-12
Sample # : -
Depth (ft) : 5.5
Date tested : 12/15/97
Soil : (CH) Dark brown fat clay

Test Report:

Strain at failure, %	3.6
Unconfined compressive strength,psf	1384.7
Shear strength,psf	692.4

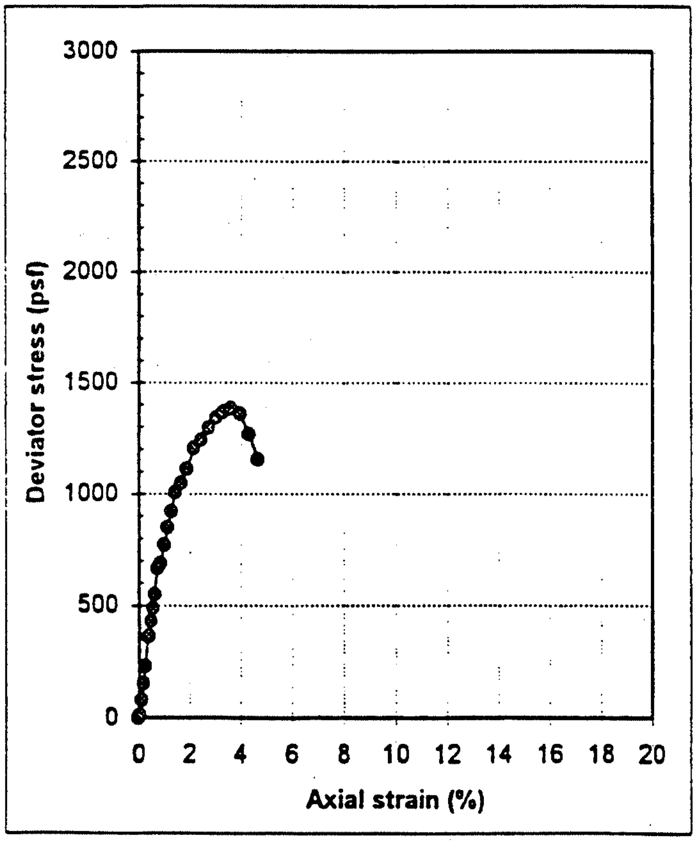
Specimen:

Total wt. = 664.8 gms
Ht. = 5.06 in
Ave dia. = 2.418 in
Area = 4.594 sq.in
Volume = 380.9 c.c.
Moisture = 35.8 %
Total density = 108.9 pcf
Dry density = 80.2 pcf

Dial factor = 0.000300 in/unit
Load factor = 0.123859 lb/unit
Shearing rate = 0.75 %/min

Data Reduction:

Dial Read.	Load Read.	Axial Strain (%)	Deviator Stress (psf)
503	171	0.00	0.0
511	175	0.05	15.5
523	192	0.12	81.4
536	211	0.20	155.0
549	231	0.27	232.3
564	265	0.36	363.6
573	266	0.41	367.3
586	283	0.49	432.7
598	298	0.56	490.3
611	313	0.64	547.8
626	344	0.73	666.8
647	350	0.85	689.0
672	372	1.00	772.6
695	392	1.14	848.3
720	411	1.29	919.8
746	434	1.44	1006.4
781	446	1.65	1050.1
818	463	1.87	1112.5
867	488	2.16	1204.2
917	499	2.45	1242.2
965	514	2.74	1295.3
1015	527	3.03	1340.3
1063	535	3.32	1366.4
1112	541	3.61	1384.7
1172	535	3.96	1357.2
1231	512	4.31	1266.8
1289	483	4.66	1154.9



UNCONFINED COMPRESSION TEST

Client : S.C.V.W.D.
Project : Berryessa Creek
Job # : 00481-005-003
Boring # : B-13
Sample # : -
Depth (ft) : 4
Date tested : 12/15/97
Soil : (CH) Dark brown fat clay w/ some gravel

Test Report:

Strain at failure. %	5.3
Unconfined compressive strength.psf	3107.4
Shear strength.psf	1553.7

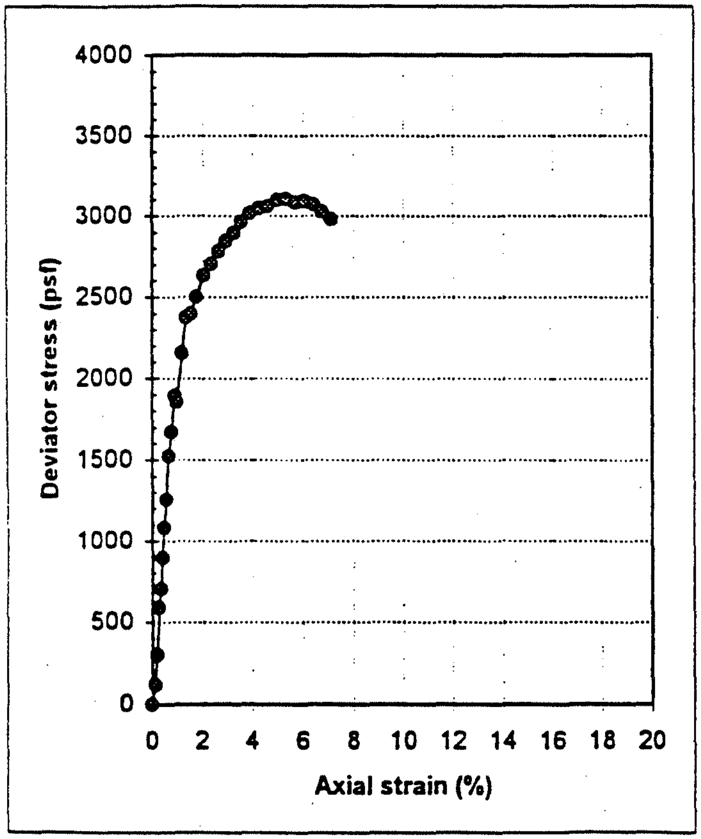
Specimen:

Total wt. = 694.0 gms
Ht. = 5.03 in
Ave dia. = 2.400 in
Area = 4.526 sq.in
Volume = 373.0 c.c.
Moisture = 29.9 %
Total density = 116.1 pcf
Dry density = 89.4 pcf

Dial factor = 0.000300 in/unit
Load factor = 0.123859 lb/unit
Shearing rate = 0.75 %/min

Data Reduction:

Dial Read.	Load Read.	Axial Strain (%)	Deviator Stress (psf)
547	171	0.00	0.0
567	202	0.12	122.0
579	247	0.19	298.9
595	321	0.29	589.5
605	350	0.35	703.0
617	399	0.42	894.8
629	447	0.49	1082.4
642	491	0.57	1254.0
656	560	0.65	1523.1
677	599	0.77	1673.7
702	656	0.92	1893.7
715	647	1.00	1857.1
747	725	1.19	2157.3
772	782	1.34	2375.6
807	789	1.55	2397.8
843	817	1.76	2501.0
892	853	2.06	2632.5
942	873	2.35	2701.4
991	896	2.65	2781.6
1039	914	2.93	2842.3
1088	930	3.22	2894.8
1138	950	3.52	2961.9
1199	967	3.88	3015.1
1260	978	4.25	3045.2
1318	984	4.59	3056.8
1382	998	4.98	3097.0
1444	1004	5.34	3107.4
1502	1000	5.69	3081.2
1564	1007	6.06	3095.0
1624	1004	6.42	3072.2
1682	995	6.76	3027.7
1743	985	7.13	2979.3



UNCONFINED COMPRESSION TEST

Client : S.C.V.W.D.
Project : Berryessa Creek
Job # : 00481-005-003
Boring # : B-13
Sample # : -
Depth (ft) : 21
Date tested : 12/18/97
Soil : (CL) Brown silty clay w/ gravel

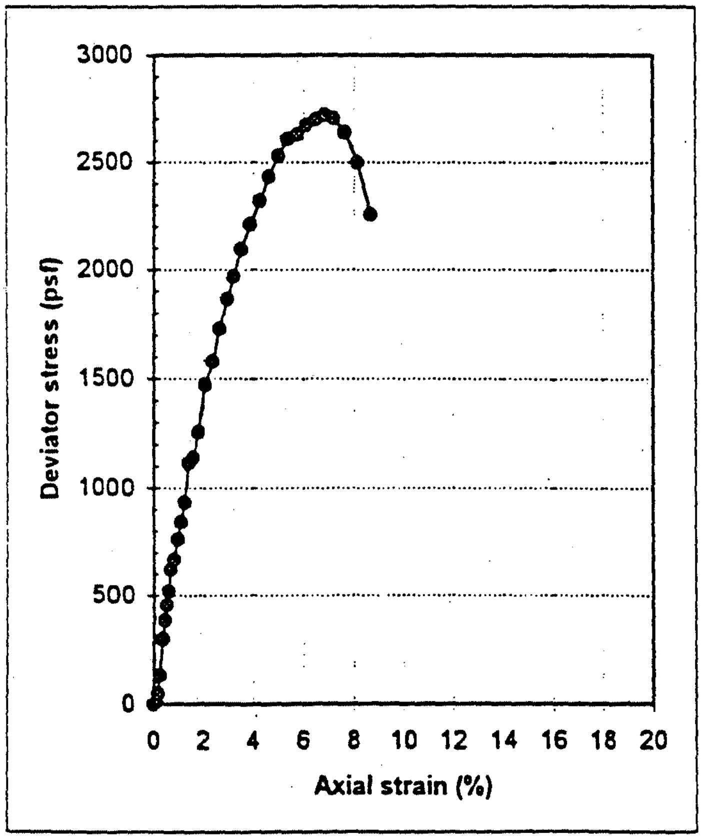
Test Report:

Strain at failure, %	6.9
Unconfined compressive strength,psf	2722.2
Shear strength,psf	1361.1

Specimen:

Total wt. = 934.6 gms
Ht. = 5.66 in
Ave dia. = 2.444 in
Area = 4.693 sq.in
Volume = 435.3 c.c.
Moisture = 16.3 %
Total density = 134.0 pcf
Dry density = 115.2 pcf

Dial factor = 0.000300 in/unit
Load factor = 0.123859 lb/unit
Shearing rate = 0.75 %/min



Data Reduction:

Dial Read.	Load Read.	Axial Strain (%)	Deviator Stress (psf)
251	170	0.00	0.0
273	173	0.12	11.4
286	182	0.19	45.5
299	205	0.25	132.7
316	249	0.34	299.2
325	250	0.39	302.8
338	272	0.46	385.8
351	291	0.53	457.4
365	308	0.60	521.3
381	335	0.69	622.7
404	347	0.81	667.2
431	372	0.95	760.4
458	394	1.10	841.9
485	418	1.24	930.8
513	467	1.39	1113.0
552	475	1.59	1140.6
592	507	1.81	1257.6
646	565	2.09	1469.7
702	596	2.39	1580.3
757	637	2.68	1727.2
812	675	2.97	1862.2
862	705	3.24	1967.4
917	741	3.53	2093.5
986	776	3.89	2213.4
1056	808	4.26	2321.3
1126	841	4.63	2431.9
1195	870	5.00	2527.3
1265	895	5.37	2607.3
1335	904	5.74	2629.3
1405	919	6.11	2672.5
1475	929	6.48	2697.5
1545	939	6.85	2722.2
1612	937	7.21	2704.8
1695	922	7.65	2639.3
1794	886	8.17	2498.7
1892	820	8.69	2255.6

UNCONFINED COMPRESSION TEST

Client : S.C.V.W.D.
Project : Berryessa Creek
Job # : 00481-005-003
Boring # : B-14
Sample # : -
Depth (ft) : 5-7.5
Date tested : 12/28/97
Soil : (CH) Dark brown/black fat clay

Test Report:

Strain at failure, %	1.1
Unconfined compressive strength,psf	3280.7
Shear strength,psf	1640.3

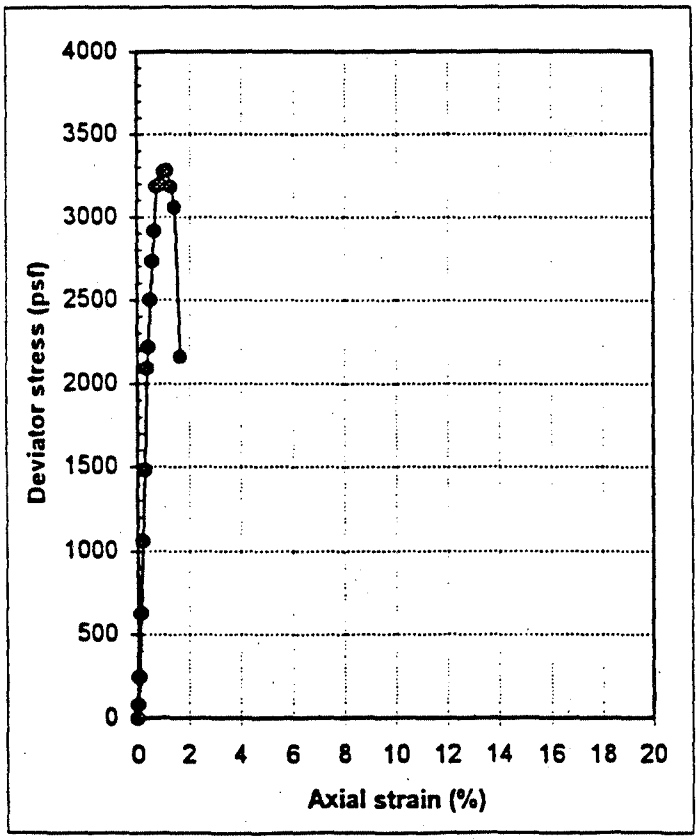
Specimen:

Total wt. = 1079.5 gms
Ht. = 5.97 in
Ave dia. = 2.850 in
Area = 6.382 sq.in
Volume = 624.4 c.c.
Moisture = 25.5 %
Total density = 107.9 pcf
Dry density = 86.0 pcf

Dial factor = 0.000300 in/unit
Load factor = 0.123859 lb/unit
Shearing rate = 0.75 %/min

Data Reduction:

Dial Read.	Load Read.	Axial Strain (%)	Deviator Stress (psf)
333	170	0.00	0.0
337	198	0.02	78.2
344	259	0.06	248.6
357	394	0.12	625.3
371	549	0.19	1057.2
385	702	0.26	1482.9
403	921	0.35	2091.4
413	967	0.40	2218.4
426	1069	0.47	2500.7
441	1153	0.54	2732.3
455	1219	0.61	2913.7
471	1317	0.69	3183.3
495	1323	0.81	3196.1
525	1352	0.96	3271.5
553	1357	1.10	3280.7
583	1323	1.26	3181.8
613	1279	1.41	3055.8
655	956	1.62	2161.1



UNCONSOLIDATED UNDRAINED COMPRESSION TEST

Client : S.C.V.W.D.
Project : Berryessa Creek
Job # : 00481-005-003
Boring # : B-7
Sample # : -
Depth (ft) : 11
Date tested : 12/19/97
Soil : (CH) Dark brown fat clay

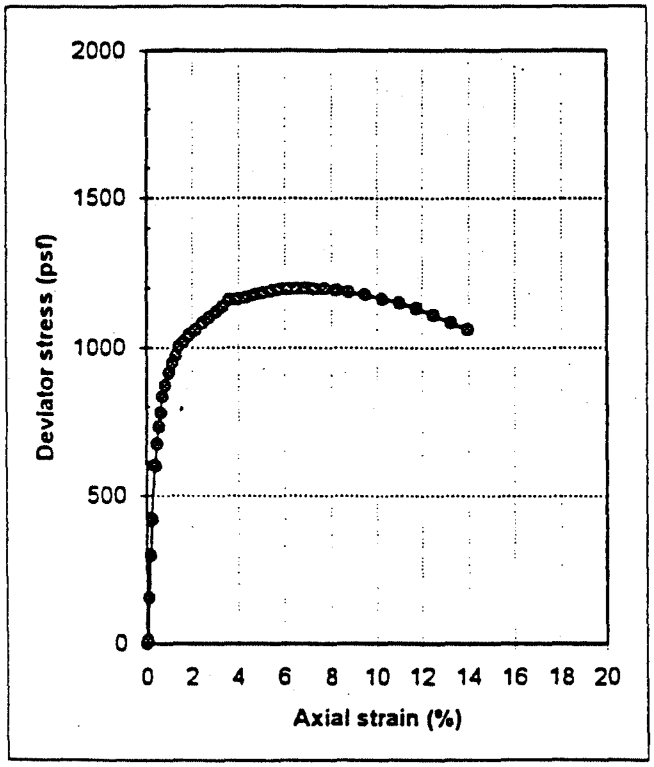
Test Report:

Strain at failure, %	6.9
Peak deviator stress,psf	1200.4
Shear strength,psf	600.2

Specimen:

Total wt. = 700.1 gms
Ht. = 5.28 in
Ave dia. = 2.388 in
Area = 4.481 sq.in
Volume = 387.7 c.c.
Moisture = 35.2 %
Total density = 112.7 pcf
Dry density = 83.3 pcf

Dial factor = 0.000300 in/unit
Load factor = 0.123859 lb/unit
Shearing rate = 0.75 %/min
SigC = 750 psf



Data Reduction:

Dial Read.	Load Read.	Axial Strain (%)	Deviator Stress (psf)
384	179	0.00	0.0
393	182	0.05	11.9
405	218	0.12	155.1
418	254	0.19	298.0
430	285	0.26	420.8
447	331	0.36	602.9
455	331	0.40	602.6
467	349	0.47	673.5
481	364	0.55	732.4
494	376	0.62	779.3
510	390	0.72	833.9
532	400	0.84	872.3
559	411	0.99	914.3
585	420	1.14	948.4
611	427	1.29	974.5
638	435	1.44	1004.4
674	440	1.65	1021.9
713	446	1.87	1043.0
765	451	2.16	1059.3
816	458	2.45	1083.4
867	463	2.74	1099.5
917	469	3.03	1119.5
970	474	3.33	1135.2
1021	481	3.62	1158.7
1085	483	3.98	1162.0
1149	486	4.34	1169.0
1212	489	4.70	1176.0
1277	492	5.07	1182.8
1342	495	5.44	1189.5
1408	498	5.81	1196.0
1473	499	6.18	1195.1
1538	501	6.55	1197.8
1605	503	6.93	1200.4
1669	503	7.29	1195.7
1747	505	7.74	1197.3
1838	506	8.25	1194.3
1930	506	8.78	1187.5
2059	506	9.51	1177.9
2191	505	10.26	1164.6
2322	504	11.00	1151.4
2453	501	11.74	1131.2
2585	498	12.49	1111.2
2718	493	13.25	1084.3
2849	489	13.99	1061.3

UNCONSOLIDATED UNDRAINED COMPRESSION TEST

Client : S.C.V.W.D.
Project : Berryessa Creek
Job # : 00481-005-003
Boring # : B-12
Sample # : -
Depth (ft) : 16
Date tested : 12/19/97
Soil : (CL) Brown clay

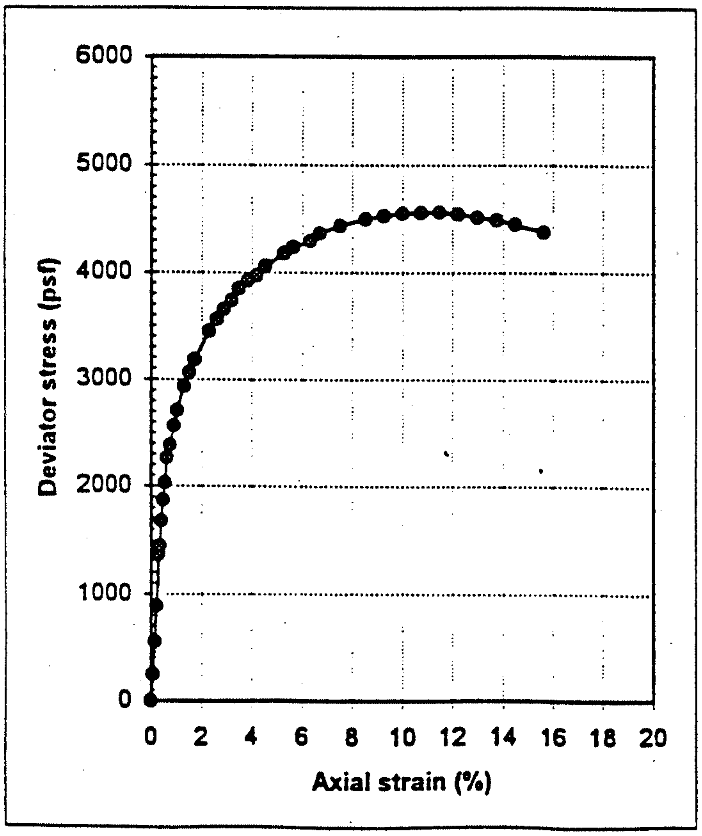
Test Report:

Strain at failure, %	11.5
Peak deviator stress,psf	4560.8
Shear strength,psf	2280.4

Specimen:

Total wt. = 828.6 gms
Ht. = 5.40 in
Ave dia. = 2.436 in
Area = 4.663 sq.in
Volume = 412.6 c.c.
Moisture = 25.6 %
Total density = 125.3 pcf
Dry density = 99.8 pcf

Dial factor = 0.000300 in/unit
Load factor = 0.123859 lb/unit
Shearing rate = 0.75 %/min
SigC = 1000 psf



Data Reduction:

Dial Read.	Load Read.	Axial Strain (%)	Deviator Stress (psf)
223	181	0.00	0.0
225	183	0.01	7.6
237	245	0.08	244.6
249	324	0.14	546.2
262	413	0.22	885.6
277	539	0.30	1365.4
285	559	0.34	1441.0
298	621	0.42	1676.1
310	672	0.48	1869.2
323	714	0.56	2027.6
337	777	0.63	2265.5
360	809	0.76	2384.1
386	857	0.90	2562.5
410	895	1.04	2702.9
462	958	1.33	2932.9
497	993	1.52	3058.9
535	1027	1.73	3180.2
641	1104	2.32	3448.9
694	1136	2.61	3557.7
746	1165	2.90	3654.9
798	1190	3.19	3736.6
850	1223	3.48	3847.3
916	1247	3.85	3921.0
977	1265	4.18	3973.1
1042	1293	4.55	4060.4
1174	1334	5.28	4177.8
1241	1355	5.65	4237.2
1364	1379	6.33	4292.6
1430	1403	6.70	4361.4
1578	1434	7.52	4432.7
1762	1467	8.54	4499.2
1895	1486	9.28	4528.8
2025	1503	10.00	4551.3
2159	1516	10.74	4558.1
2293	1528	11.49	4560.8
2427	1534	12.23	4542.6
2562	1538	12.98	4517.1
2698	1542	13.74	4491.1
2834	1542	14.49	4451.8
3038	1539	15.62	4383.2

Dames and Moore, Inc.

UNCONSOLIDATED UNDRAINED COMPRESSION TEST

Client : S.C.V.W.D.
Project : Berryessa Creek
Job # : 00481-005-003
Boring # : B-14
Sample # : 2
Depth (ft) : 15-17
Date tested : 12/19/97
Soil : (ML) Brown silt, partially cemented

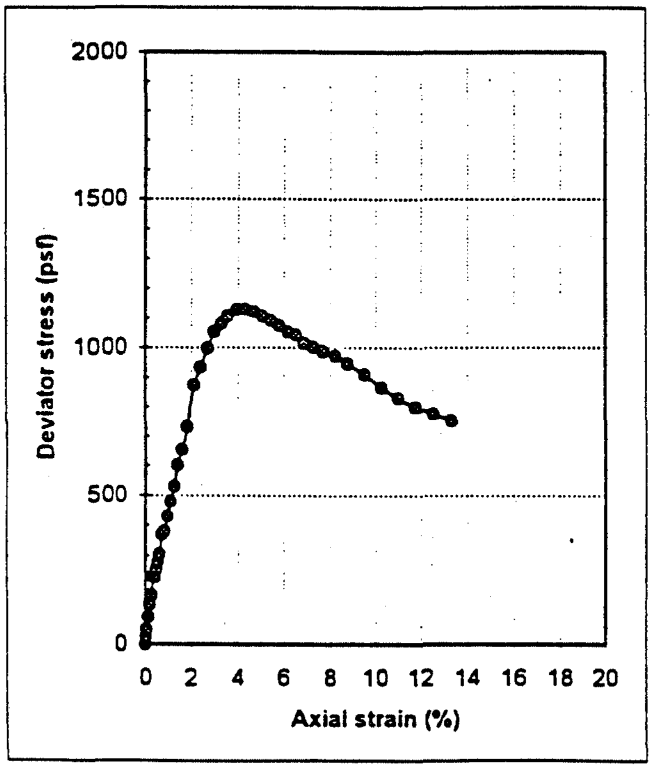
Test Report:

Strain at failure, %	4.3
Peak deviator stress,psf	1130.2
Shear strength,psf	565.1

Specimen:

Total wt. = 1345.3 gms
Ht. = 5.99 in
Ave dia. = 2.878 in
Area = 6.508 sq.in
Volume = 638.8 c.c.
Moisture = 19.6 %
Total density = 131.4 pcf
Dry density = 109.9 pcf

Dial factor = 0.000300 in/unit
Load factor = 0.123859 lb/unit
Shearing rate = 0.75 %/min
SigC = 1000 psf

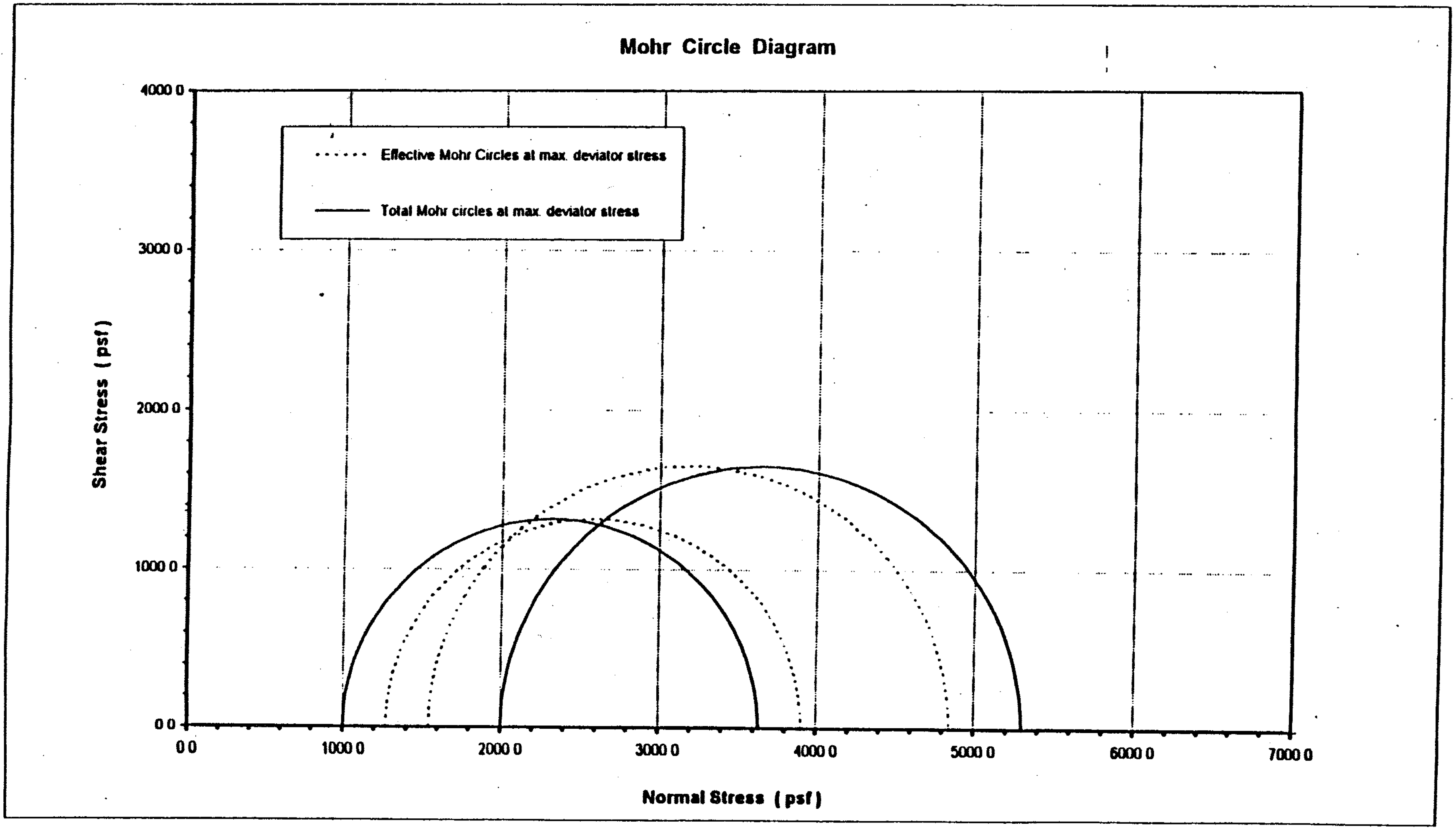


Data Reduction:

Dial Read.	Load Read.	Axial Strain (%)	Deviator Stress (psf)
202	189	0.00	0.0
206	198	0.02	24.7
213	208	0.06	52.0
227	223	0.13	93.1
241	238	0.20	134.0
255	250	0.27	166.7
271	272	0.35	226.7
283	272	0.41	226.5
297	282	0.48	253.7
311	291	0.55	278.0
326	301	0.62	305.0
343	325	0.71	370.1
368	329	0.83	380.5
397	347	0.98	428.8
425	366	1.12	479.7
455	385	1.27	530.4
483	412	1.41	602.6
523	431	1.61	652.6
566	461	1.82	731.9
625	515	2.12	874.5
684	538	2.41	933.4
743	563	2.71	997.2
801	585	3.00	1052.7
859	597	3.29	1081.4
915	608	3.57	1107.3
990	617	3.94	1126.7
1065	620	4.32	1130.2
1140	618	4.69	1120.5
1213	614	5.06	1105.8
1288	610	5.43	1091.1
1362	605	5.80	1073.9
1437	599	6.18	1054.2
1512	596	6.55	1042.3
1585	587	6.92	1015.3
1657	583	7.28	1001.2
1745	579	7.72	986.3
1851	576	8.25	973.1
1957	568	8.78	947.5
2107	556	9.53	909.9
2257	541	10.28	865.5
2407	529	11.03	829.0
2556	519	11.78	797.9
2709	513	12.54	776.6
2861	506	13.30	753.2

Berryessa Creek 00481-005-003

Sample ID	SigC (psf)	Dry density (pcf)	Moisture (%)	Strain (%)	Deviator (psf)	P.W.P. (psf)	Sig1/Sig3
B-8 # 3 @ 16 ft. (CL - Lt.brn silty clay)	1000	103.8	24.2	10.35	2632.8	-269.8	3.07
B-8 # 3 @ 16 ft. (CL - Lt.brn silty clay)	2000	101.6	24.7	3.85	3299.4	457.2	3.14



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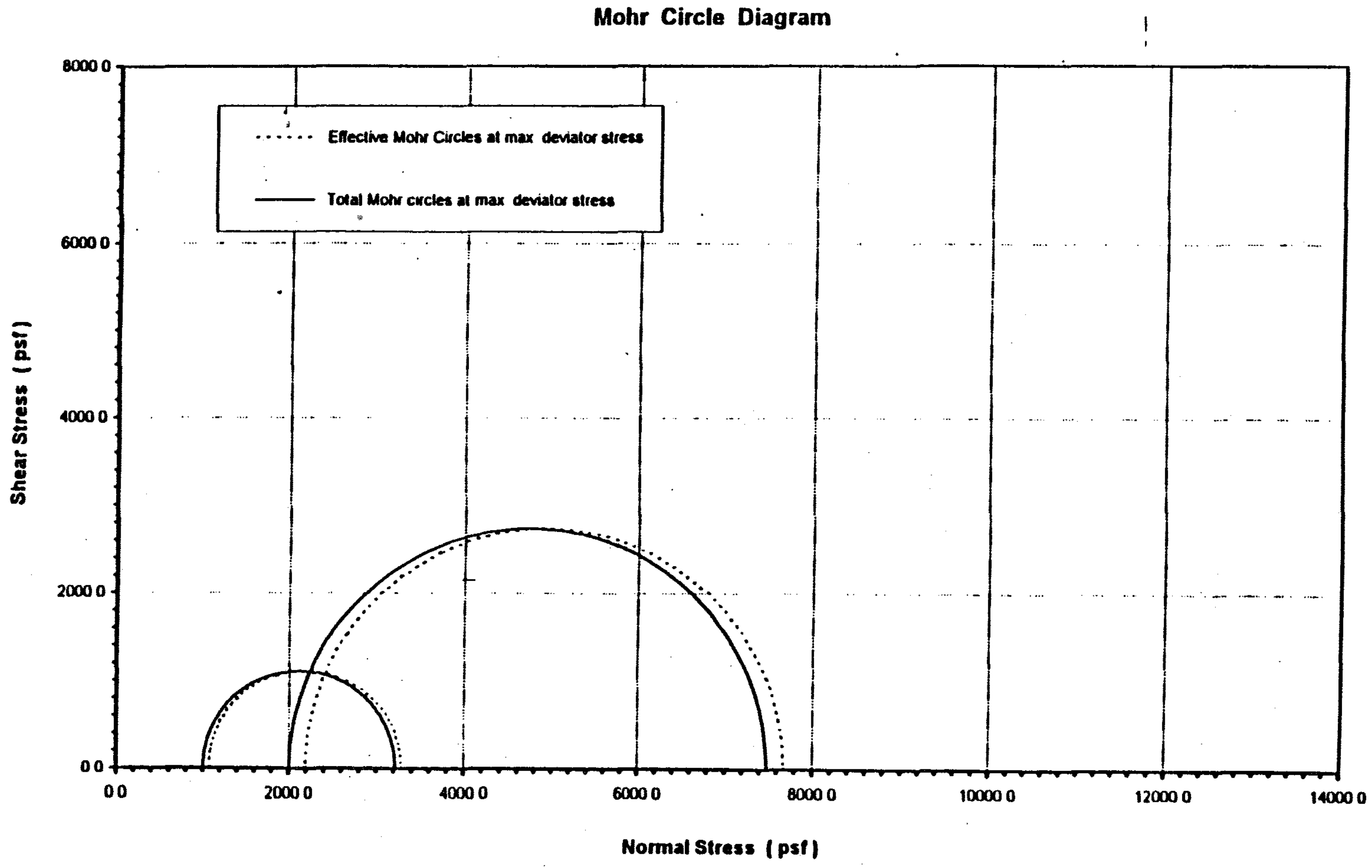
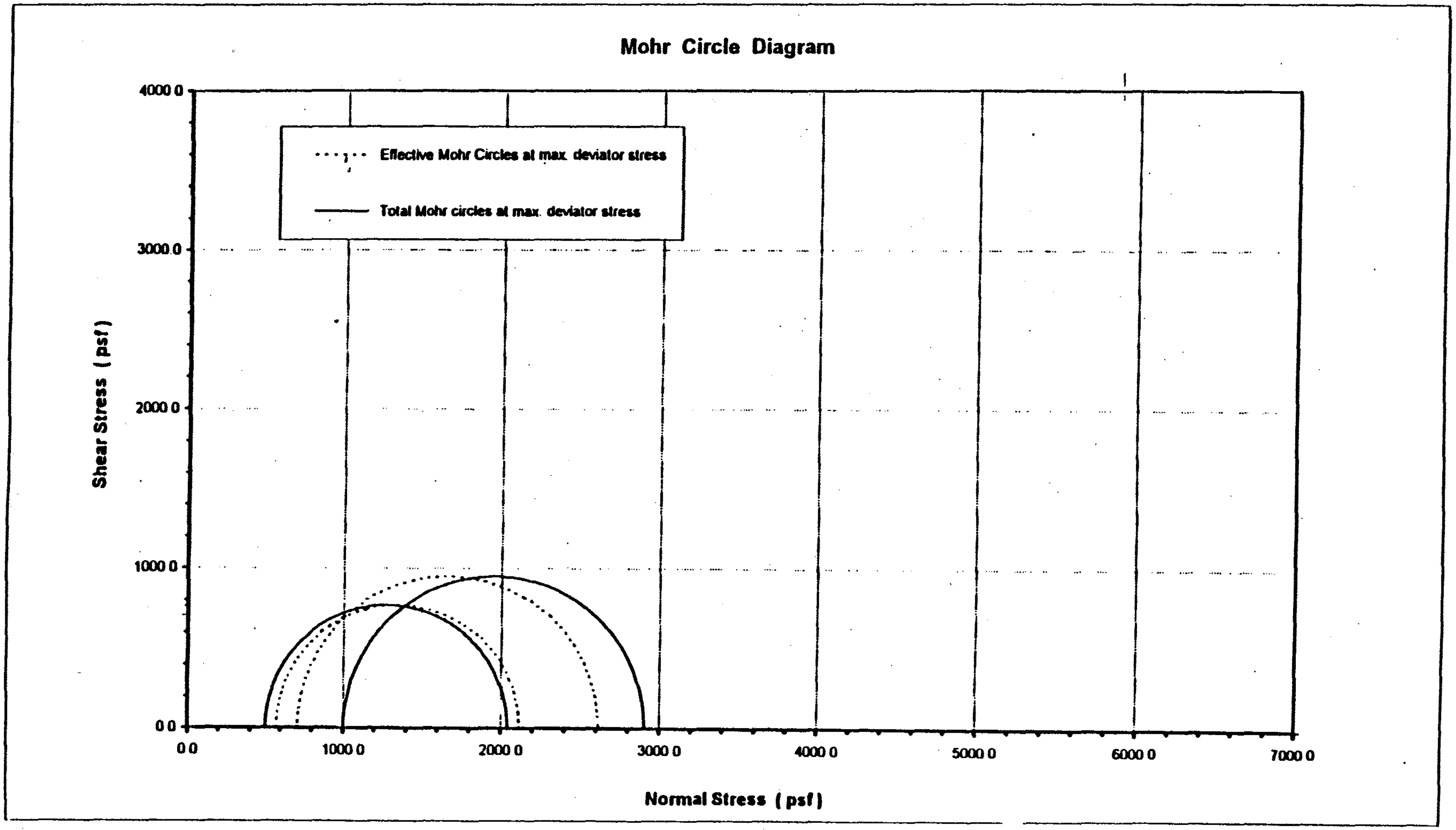
Berryessa Creek 00481-005-003

Sample ID	SigC (psf)	Dry density (pcf)	Moisture (%)	Strain (%)	Deviator (psf)	P.W.P. (psf)	Sig1/Sig3
B-9 # 4 @ 15 ft. (CL - Brn sandy clay)	1000	102.7	23.6	9.94	2216.7	-68.6	3.07
B-9 # 4 @ 15 ft. (CL - Brn sandy clay)	2000	117.2	16.1	9.91	5482.7	-187.5	3.51



Berryessa Creek 00481-005-003

Sample ID	SigC (psf)	Dry density (pcf)	Moisture (%)	Strain (%)	Deviator (psf)	P.W.P. (psf)	Sig1/Sig3
B-11 @ 4 ft. (CH - Dk brown fat clay)	500	94.8	24.3	10.24	1543.6	-73.2	3.69
B-11 @ 5 ft. (CH - Dk brown fat clay)	1000	85.5	34.1	4.29	1905.8	292.6	3.69



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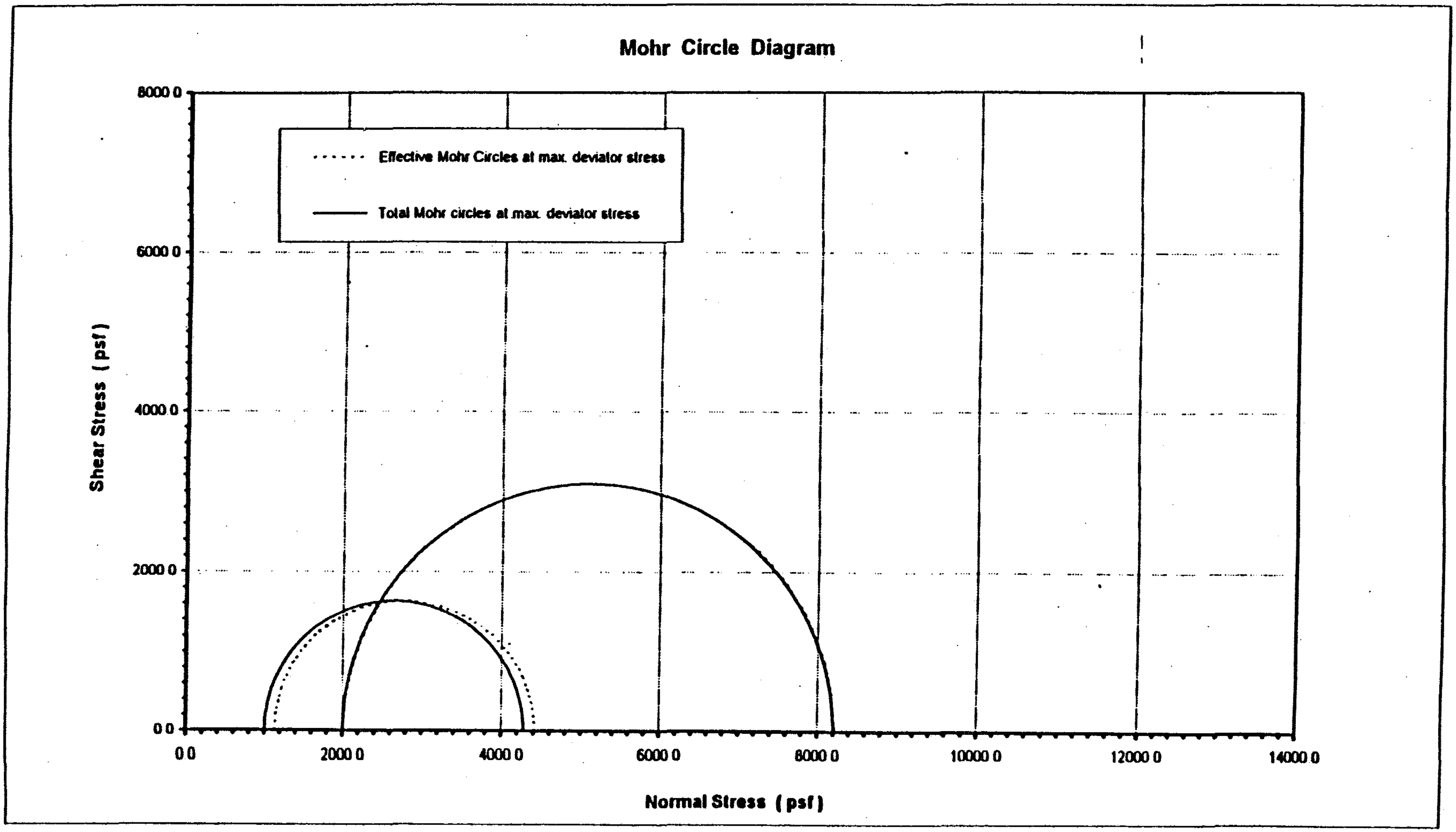
Berryessa Creek 00481-005-003

Sample ID	SigC (psf)	Dry density (pcf)	Moisture (%)	Strain (%)	Deviator (psf)	P.W.P. (psf)	Sig1/Sig3
B-11 @ 20.5 ft. (SC/SM - Grayish brown)	1000	104.6	22.6	9.84	3276.8	-132.6	3.89
B-11 @ 21 ft. (SC/SM w/ tr. fine gravel)	2000	114.0	17.7	9.94	6201.8	-13.7	4.08



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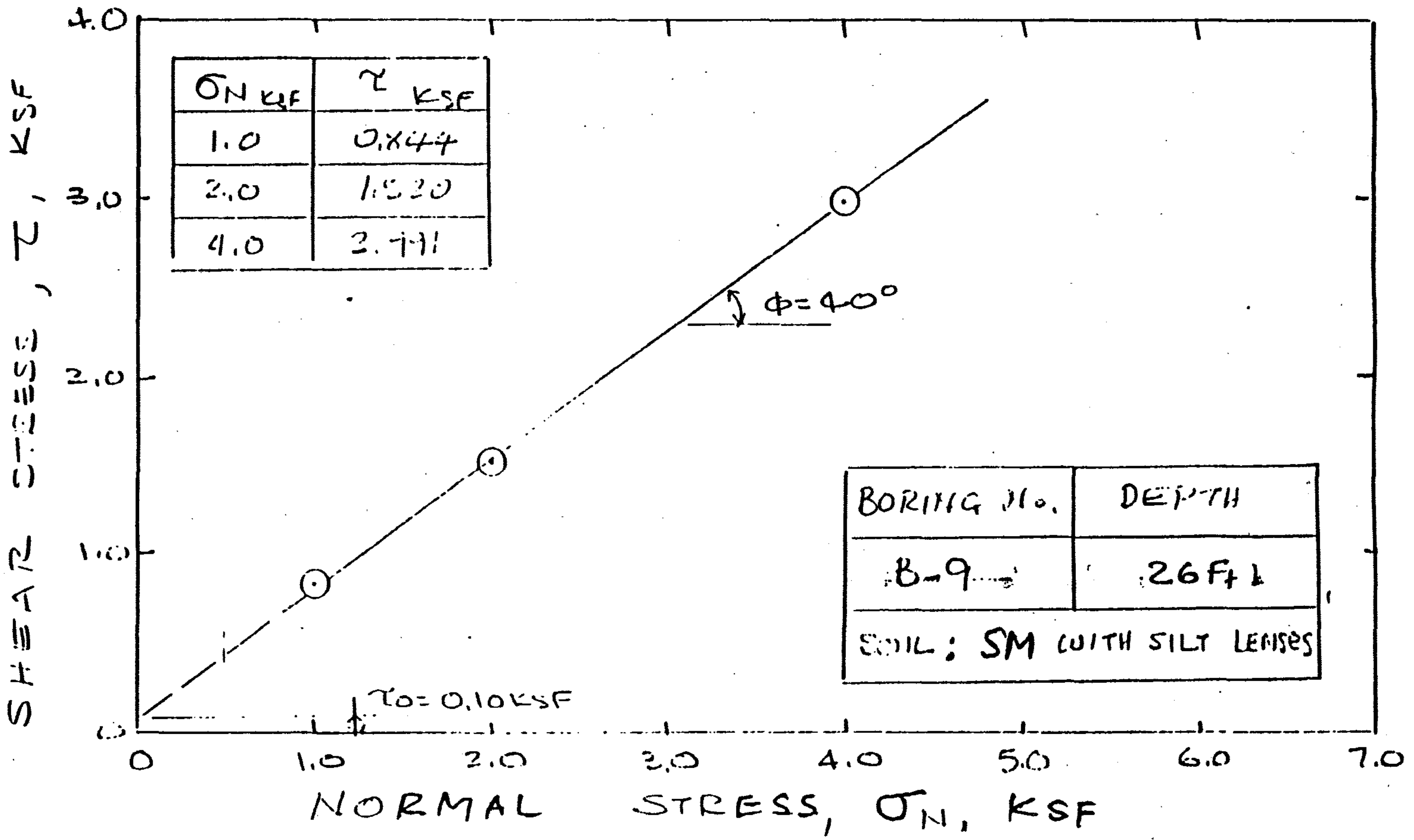
BERRYESSA CREEK PROJECT



σ_N KSF	τ KSF
1.0	0.844
2.0	1.520
4.0	2.991

BORING No.	DEPTH
B-9	26Ft
SOIL: SM WITH SILT LENSES	

SUMMARY OF THE RESULTS OF CONSOLIDATED "UNDRAINED"* DIRECT SHEAR TESTS

* NOTE: THE TERM "UNDRAINED" IS USED TO [illegible] FAST SHEAR CASE

SUBJECT BERRYESSA CREEK PROJECT SHEET ___ OF ___

DAMES & MOORE

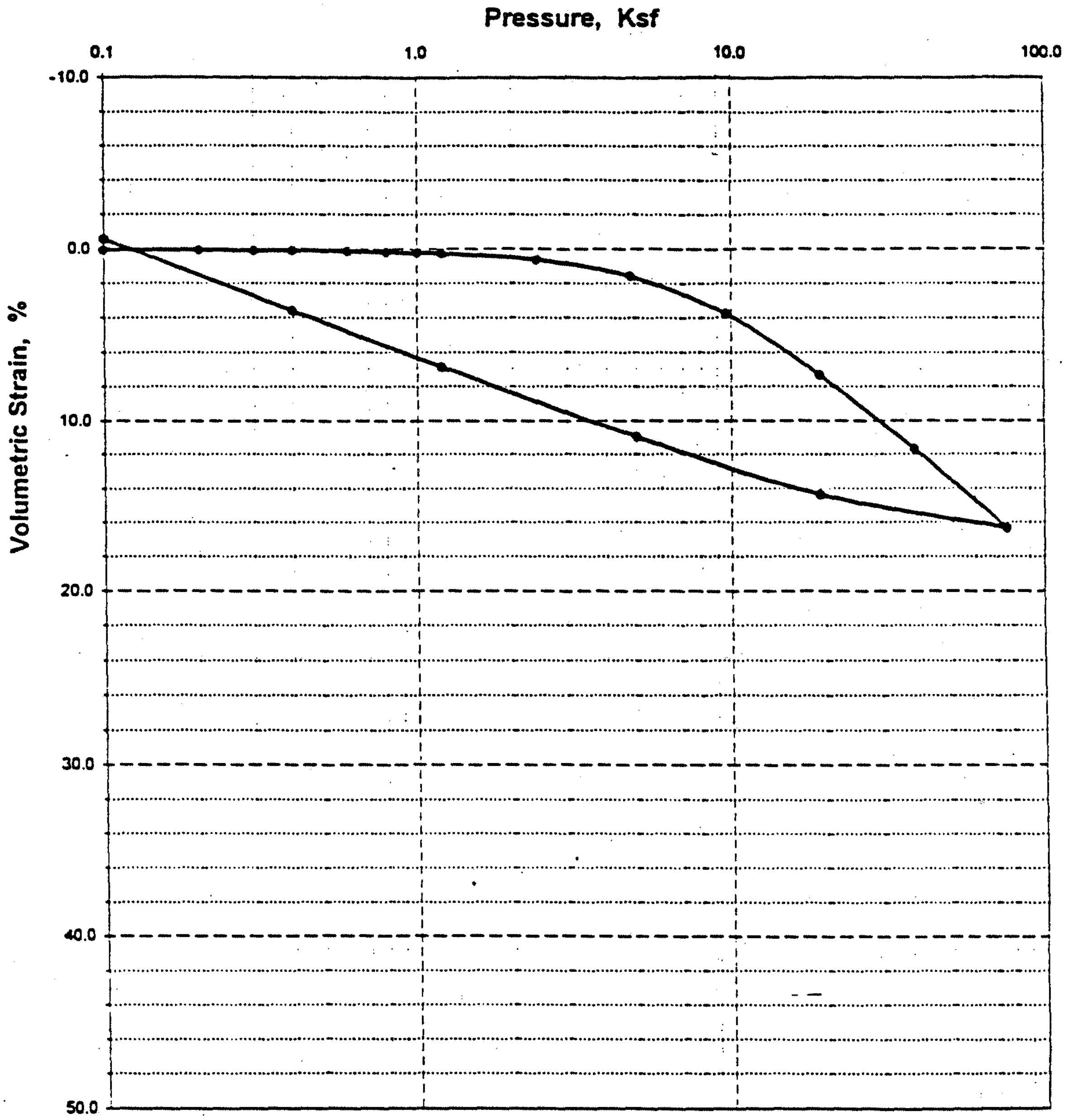
(12/88) PRINTED IN U.S.A.

CONSOLIDATION TEST

Sample ID : Boring 8 # 3 Depth 16 ft.

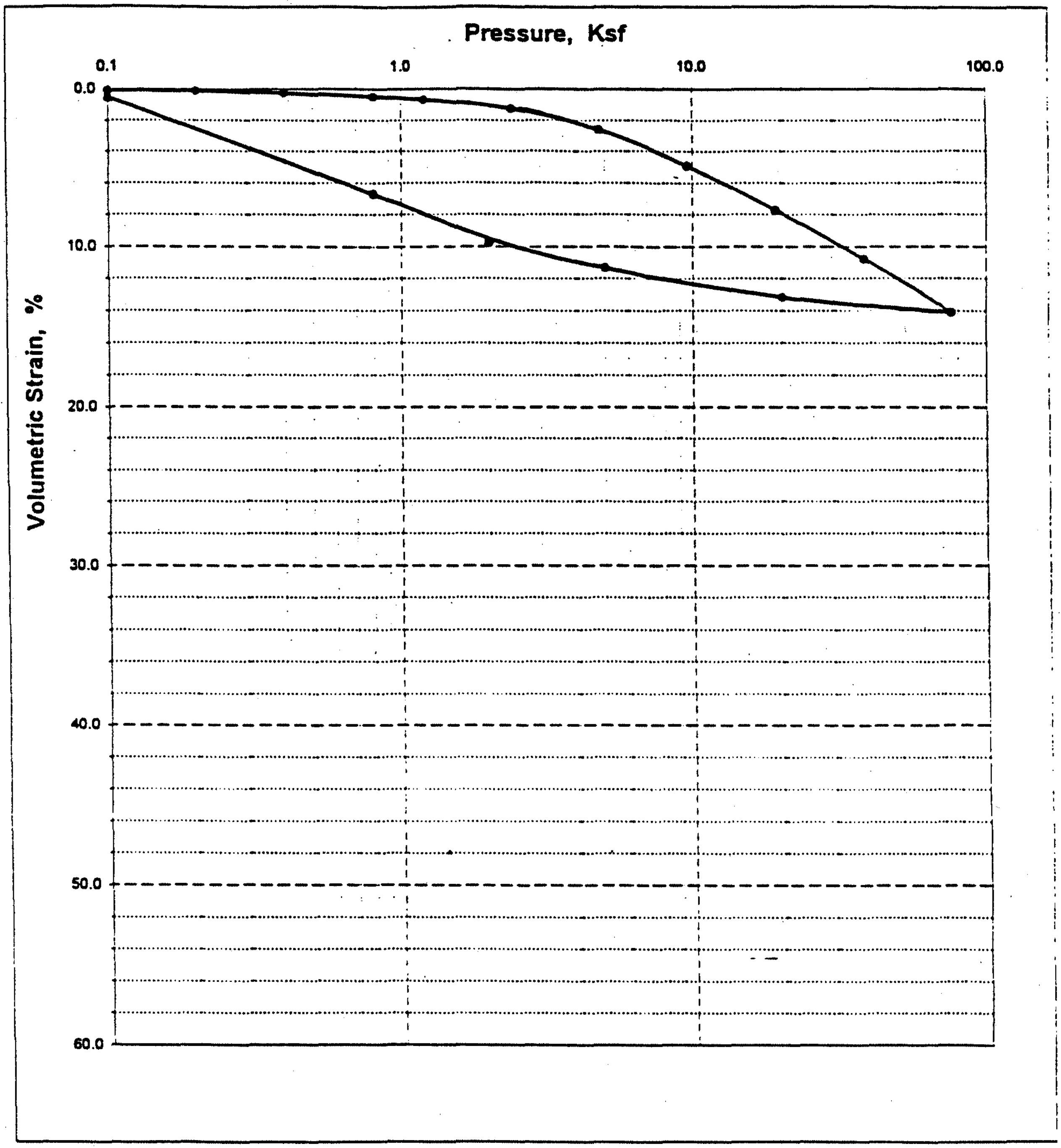
Material : (CL) Light brown silty clay

	Water Content, %	Total unit Weight, pcf	Void Ratio	Saturation %	Height in	Diameter in	Specific Gravity	Liquid Limit, %	Plasticity Index, %
Initial	26.8	125.5	0.734	100.5	1.00	2.416	(assumed) 2.75	-	-
Final	27.8	125.8	0.743	103.0	1.006				



CONSOLIDATION TEST

Sample ID : Boring 9 # 4 Depth 15 ft.									
Material : (CL) Brown sandy clay									
	Water Content, %	Total unit Weight, pcf	Void Ratio	Saturation %	Height in	Diameter in	Specific Gravity	Liquid Limit, %	Plasticity Index, %
Initial	17.7	130.8	0.544	89.7	1.00	2.416	(assumed) 2.75	-	-
Final	19.5	133.4	0.536	99.8	0.995				



00481-005-003

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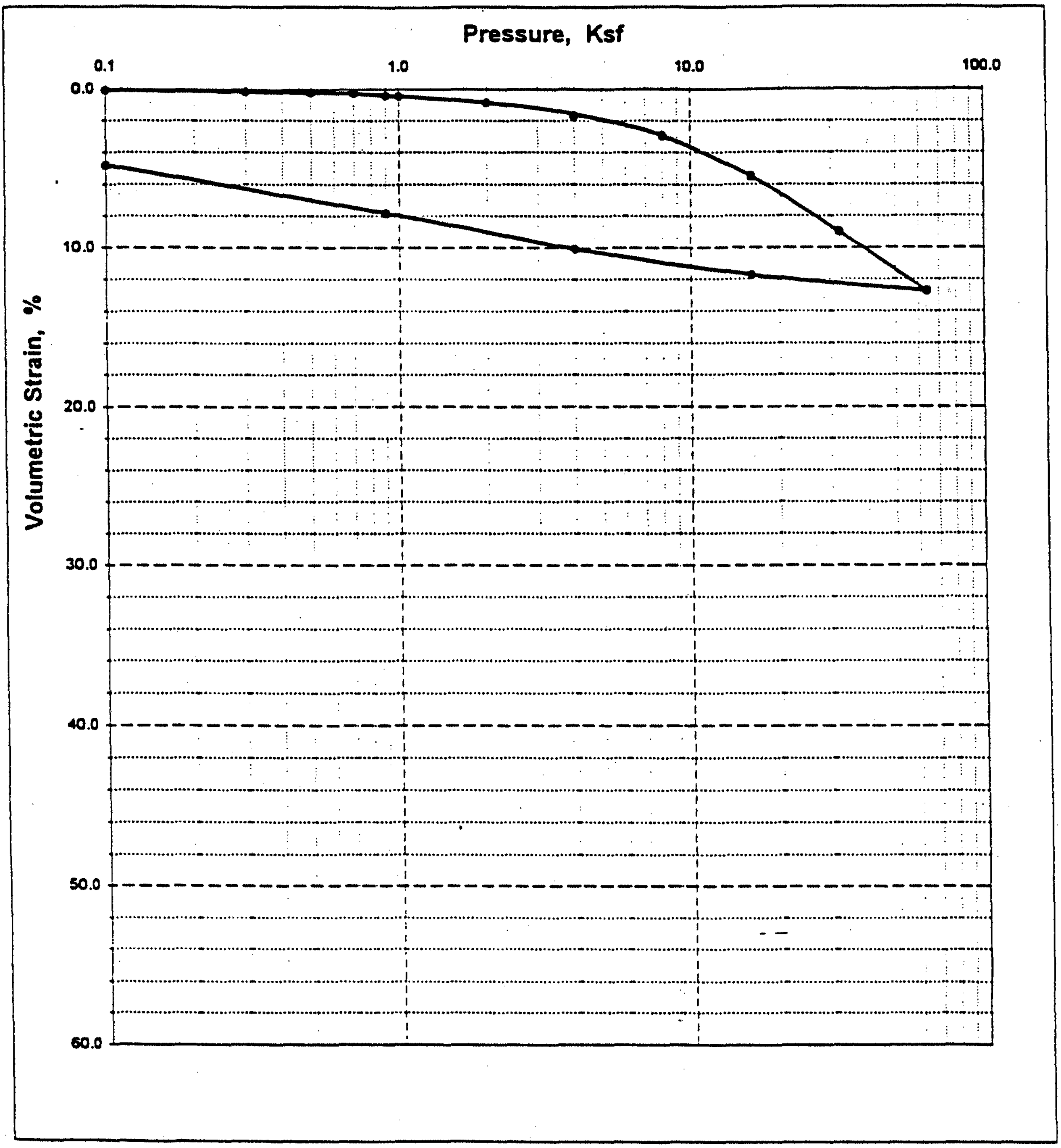
Plate ______

CONSOLIDATION TEST

Sample ID : Boring 11 Depth 25 ft.									
Material : (CL) Brown silty clay w/ occasional small nodules									
	Water Content, %	Total unit Weight, pcf	Void Ratio	Saturation %	Height in	Diameter in	Specific Gravity	Liquid Limit, %	Plasticity Index, %
Initial	20.9	127.5	0.628	91.6	1.00	2.416	(assumed) 2.75	-	-
Final	19.8	132.7	0.549	99.1	0.952				



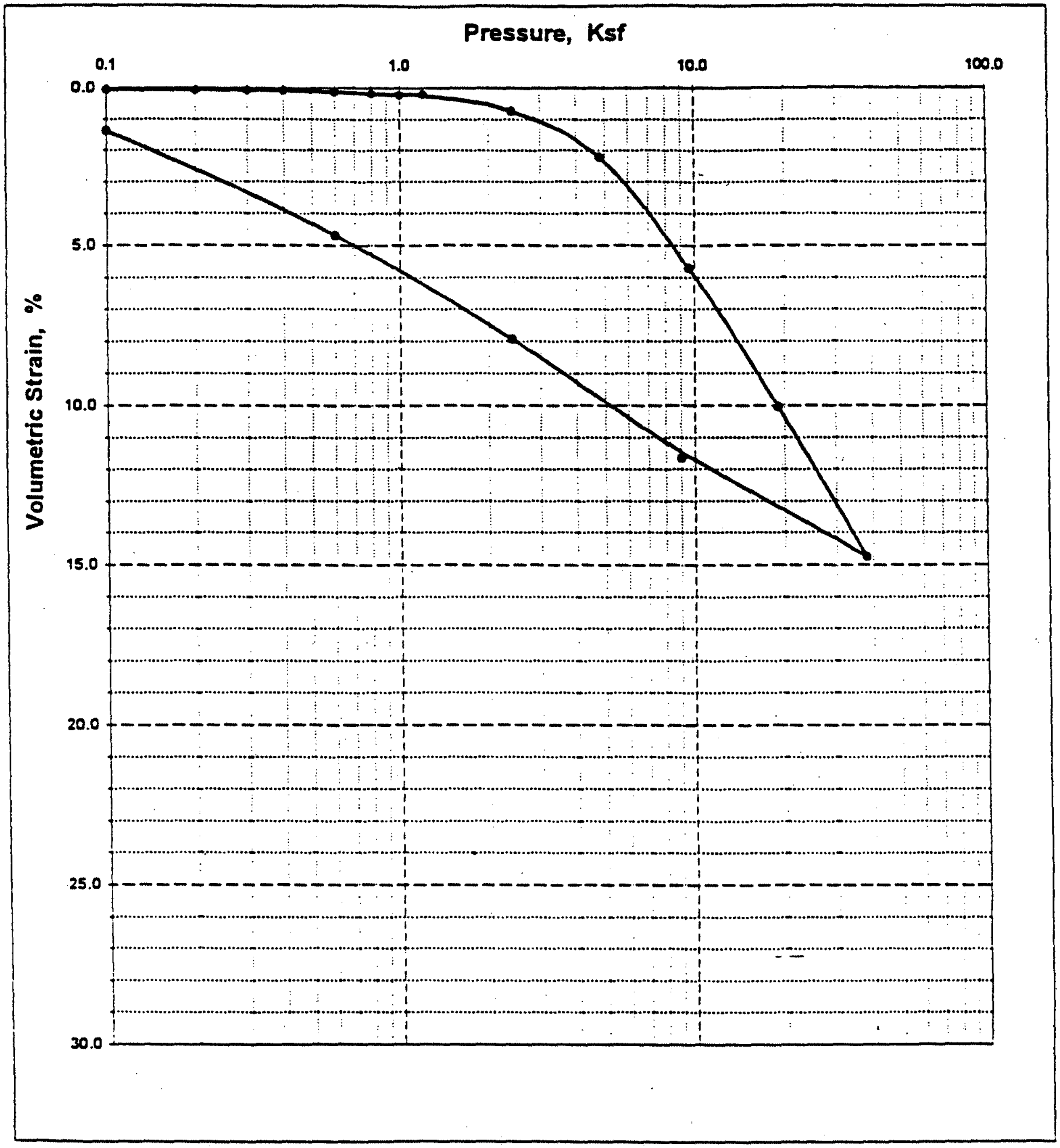
00481-005-003 Berryessa Creek

Dames & Moore

Plate ______

CONSOLIDATION TEST

Sample ID : Boring 11 Depth 10 ft.									
Material : (CH) Black / dark brown fat clay									
	Water Content, %	Total unit Weight, pcf	Void Ratio	Saturation %	Height in	Diameter in	Specific Gravity	Liquid Limit, %	Plasticity Index, %
Initial	35.9	116.2	1.007	98.1	1.00	2.416	(assumed) 2.75	-	-
Final	36.5	118.3	0.980	102.4	0.986				



00481-005-003 Berryessa Creek

Dames & Moore

Plate ______

PERMEABILITY TEST (ASTM D5084-90, method C)

Client : S.C.V.W.D.
Project : Berryessa Creek
Job # : 00481-005-003
Boring # : B-8
Sample # : -
Depth (ft) : 5.5
Date setup for test : 12/97
Soil : (CH) Dark brown / black fat clay (disturbed)

Specimen:

		Initial	Final	
Total wt.	=	318.4	347.9	gms
Ht.	=	2.320	2.345	in
Ave dia.	=	2.400		in
Area	=	4.526	4.634	sq.in
Volume	=	172.1	178.1	c.c.
Moisture	=	20.2	31.3	%
Total density	=	115.5	121.9	pcf
Dry density	=	96.1	92.8	pcf

		Head	Tail	
Area of pipettes	=	0.875	0.875	sq. cm.

Sig3 = 500 psf

Data reductions:

	Elapsed Time (min)	Inflow (c.c.)	Outflow (c.c.)	Inflow / Outflow	h1 (cm)	h2 (cm)	Ln(h1/h2)	Rt	Gradient	K20 (cm/sec)
1.	2	0.80	0.80	1.00	71.4	69.5	0.02596	0.907	11.8	1.709E-05
2.	2	0.70	0.70	1.00	69.5	67.9	0.02328	0.907	11.5	1.533E-05
3.	2	0.70	0.65	1.08	67.9	66.4	0.02297	0.907	11.3	1.513E-05
4.	2	0.65	0.65	1.00	66.4	64.9	0.02263	0.907	11.0	1.490E-05

NO GOOD,
DISTURBED
SPECIMEN.

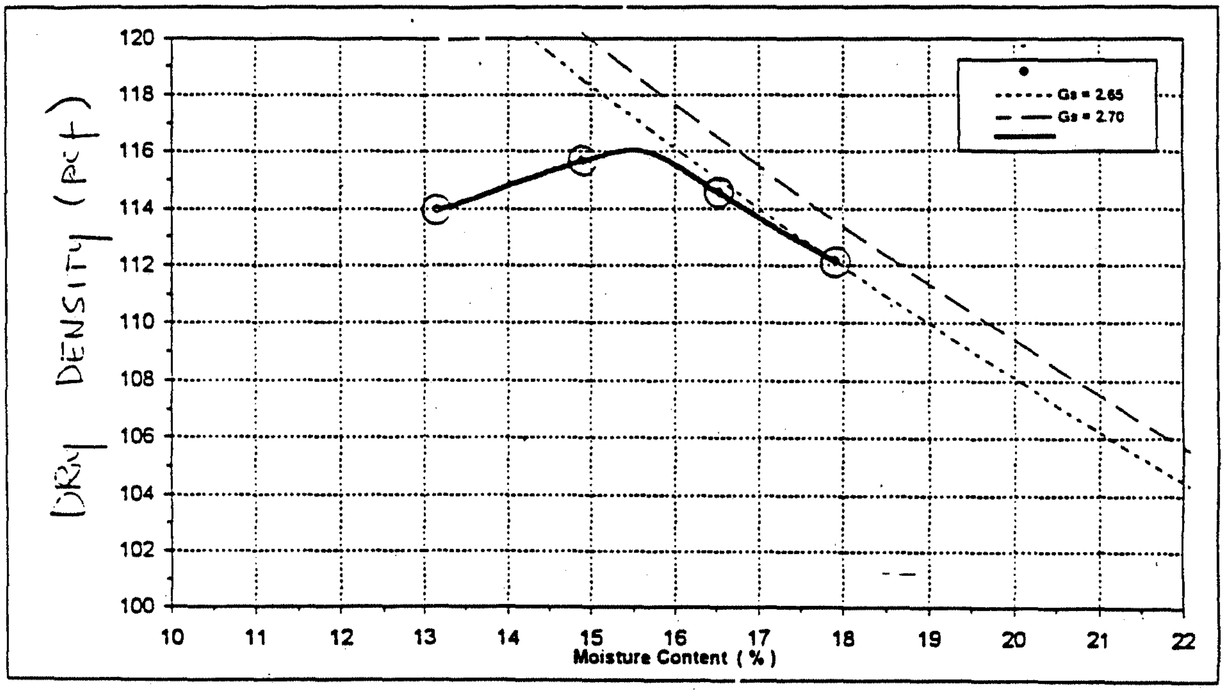
Overall average: 1.561E-05

COMPACTION TEST

Client : Santa Clara Water District
Project : Berryessa Creek
Job # : 00481-005-003
Boring # : B-8
Sample # : –
Depth (ft) : 3 - 4
Date tested : 12/24/97
Tested by : SCC/WL
Soil : (CH) Dark brown / black fat clay w/ tr sand
Notes :

Method of Compaction : ASTM D1557 - 91 - " B "
Wt. of mold : 2028.8 gms
Volume of mold : 0.033333 cu. ft.

Wt. of specimen + mold (gm)	4027.6	4046.6	4038.5	3978.1			
Wet wt. of soil + dish wt. (gm)	2037.8	1793.8	2139.4	2082.5			
Dry wt. of soil + dish wt. (gm)	1753.9	1555.0	1882.9	1859.6			
Wt. of dish (gm)	167.2	110.6	162.1	166.1			
Dish ID	LW1	921	EG2	FJR6			
Wet Density (pcf)	132.2	133.5	132.9	128.9			
Dry Density (pcf)	112.1	114.5	115.7	113.9			
Moisture Content (%)	17.9	16.5	14.9	13.2			



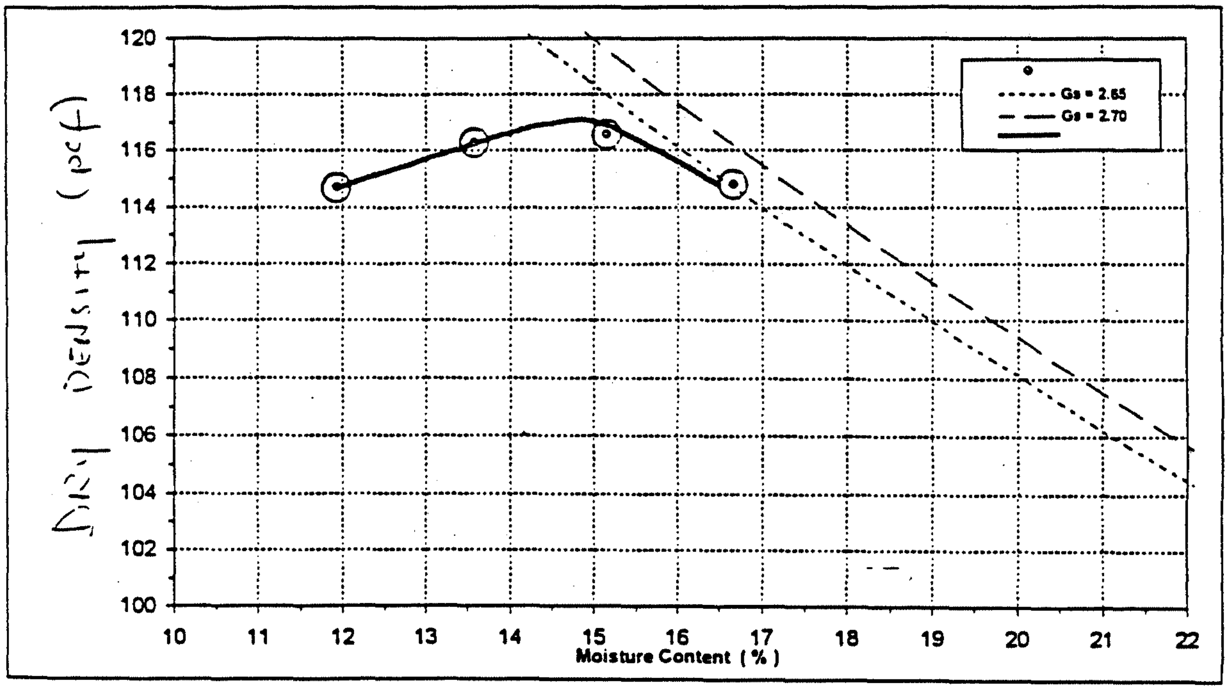
	Maximum Dry density (pcf)	Optimum Moisture (%)	L.L. (%)	P.I. (%)	-#200 (%)	M.C. as Received (%)
Test Results :	116.0	15.5	60	39	-	-

COMPACTION TEST

Client : Santa Clara Water District
Project : Berryessa Creek
Job # : 00481-005-003
Boring # : B-9
Sample # : –
Depth (ft) : 3 - 5
Date tested : 12/27/97
Tested by : WL
Soil : (CH) Dark gray / gray fat clay w/ tr sand
Notes :

Method of Compaction : ASTM D1557 - 91 - " B "
Wt. of mold : 2028.6 gms
Volume of mold : 0.033333 cu. ft.

Wt. of specimen + mold (gm)	3970.2	4025.4	4057.7	4053.1			
Wet wt. of soil + dish wt. (gm)	1988.6	1978.7	1813.7	1940.1			
Dry wt. of soil + dish wt. (gm)	1787.7	1755.7	1589.4	1678.3			
Wt. of dish (gm)	105.7	112.7	109.2	107.3			
Dish ID	GF1	DD	WTL	911			
Wet Density (pcf)	128.4	132.1	134.2	133.9			
Dry Density (pcf)	114.7	116.3	116.5	114.8			
Moisture Content (%)	11.9	13.6	15.2	16.7			



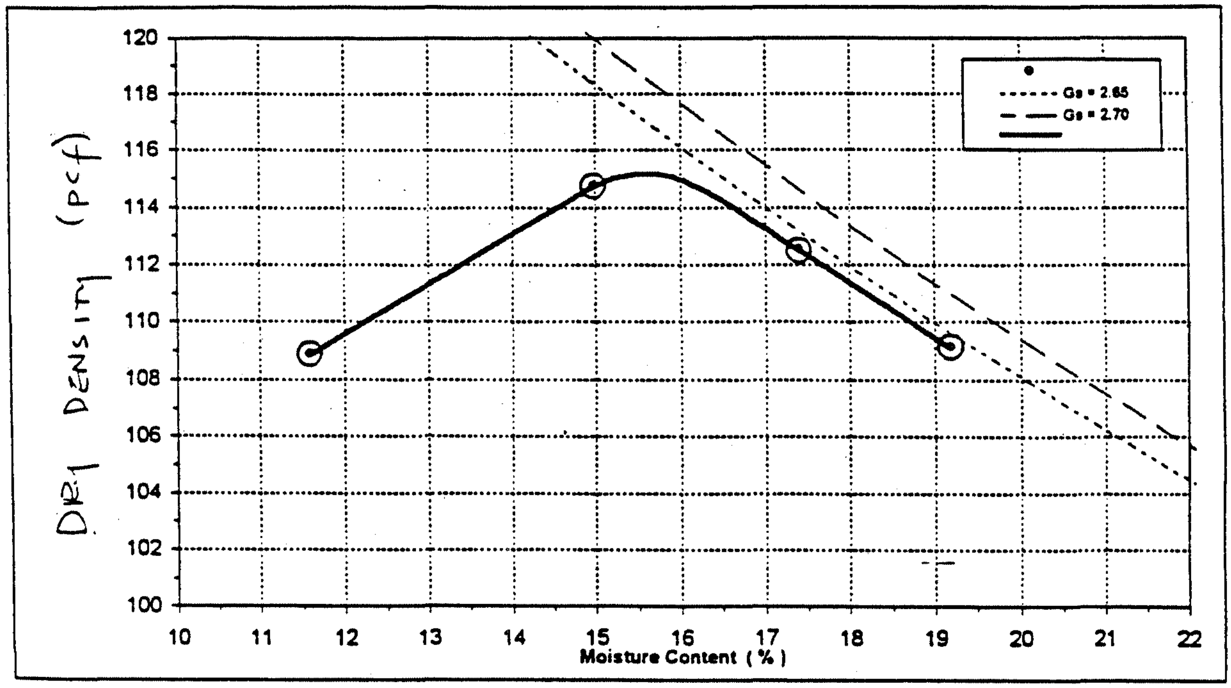
	Maximum Dry density (pcf)	Optimum Moisture (%)	L.L. (%)	P.I. (%)	-#200 (%)	M.C. as Received (%)
Test Results :	117.0	15.0	57	37	-	-

COMPACTION TEST

Client : Santa Clara Water Department
Project : Berryessa
Job # : 00481-005-003
Boring # : B-11
Sample # : –
Depth (ft) : 3 -5
Date tested : 12/11/97
Tested by : SCC/WL
Soil : (CH) Dark brown / black fat clay w/ tr sand
Notes :

Method of Compaction : ASTM D1557 - 91 - " B "
Wt. of mold : 2036.4 gms
Volume of mold : 0.033333 cu. ft.

Wt. of specimen + mold (gm)	3873.6	4030.9	4033.9	4002.7			
Wet wt. of soil + dish wt. (gm)	1961.3	2077.1	2064.9	1900.4			
Dry wt. of soil + dish wt. (gm)	1775.0	1827.8	1774.9	1621.0			
Wt. of dish (gm)	167.5	162.1	107.7	164.2			
Dish ID	FJR5	EG2	GF5	MOE3			
Wet Density (pcf)	121.5	131.9	132.1	130.0			
Dry Density (pcf)	108.9	114.7	112.5	109.1			
Moisture Content (%)	11.6	15.0	17.4	19.2			



	Maximum Dry density (pcf)	Optimum Moisture (%)	L.L. (%)	P.I. (%)	-#200 (%)	M.C. as Received (%)
Test Results :	115.0	15.5	61	40	-	-

APPENDIX C

Output File of Seepage Analysis

BERRYESSA CREEK STEADY SEEPAGE ANALYSES

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************************************************************************

 INPUT     PROBLEM     PARAMETERS

     NUMBER OF NODES  ....................   86
     NUMBER OF ELEMENTS  .................   68
     NUMBER OF DIFF  MATERIALS  ..........    3
     PROB OPTION (0=AXI-SYMM ,1=PLANE)  ...   1
     FIXED HEAD NODES (BC)  ..............    8
     FIXED SEEPAGE NODES  ................    0
     FREE SURFACE SEEPAGE NODES  ..........   8
     HR VALUE  ..........................  .100D+01

************************************************************************


 INPUT          MATERIAL PROPERTIES (Permeability feet/min)

  MATL       K1S        K2S          ANG

    1 (sand)    .20D-02     .20D-02     .00D+00
    2 (clay)    .20D-05     .20D-05     .00D+00
    3 (fill)    .20D-05     .20D-05     .00D+00


 INPUT          NODAL DATA

      NODE          X              Y
        1      .0000D+00      .1500D+02
        2      .1000D+02      .1500D+02
        3      .2000D+02      .1500D+02
        4      .3000D+02      .1500D+02
        5      .4000D+02      .1500D+02
        6      .5000D+02      .1500D+02
        7      .6000D+02      .1500D+02
        8      .7180D+02      .1500D+02
        9      .8060D+02      .1500D+02
       10      .9000D+02      .1500D+02
       11      .9720D+02      .1500D+02
       12      .1128D+03      .1500D+02
       13      .1200D+03      .1500D+02
       14      .1300D+03      .1500D+02
       15      .1400D+03      .1500D+02
       16      .1500D+03      .1500D+02
       17      .0000D+00      .1800D+02
       18      .1000D+02      .1800D+02
       19      .2000D+02      .1800D+02
       20      .3000D+02      .1800D+02
       21      .4000D+02      .1800D+02
       22      .5000D+02      .1800D+02
       23      .6000D+02      .1800D+02
       24      .7180D+02      .1800D+02
       25      .8060D+02      .1800D+02
       26      .9000D+02      .1800D+02
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27        .9720D+02        .1800D+02
28        .1122D+03        .1800D+02
29        .1200D+03        .1800D+02
30        .1300D+03        .1800D+02
31        .1400D+03        .1800D+02
32        .1500D+03        .1800D+02
33        .0000D+00        .2000D+02
34        .1000D+02        .2000D+02
35        .2000D+02        .2000D+02
36        .3000D+02        .2000D+02
37        .4000D+02        .2000D+02
38        .5000D+02        .2000D+02
39        .6000D+02        .2000D+02
40        .7180D+02        .2000D+02
41        .8060D+02        .2000D+02
42        .9000D+02        .2000D+02
43        .9720D+02        .2000D+02
44        .1128D+03        .2000D+02
45        .1200D+03        .2000D+02
46        .1300D+03        .2000D+02
47        .1400D+03        .2000D+02
48        .1500D+03        .2000D+02
49        .0000D+00        .2500D+02
50        .1000D+02        .2500D+02
51        .2000D+02        .2500D+02
52        .3000D+02        .2500D+02
53        .4000D+02        .2500D+02
54        .5000D+02        .2500D+02
55        .6000D+02        .2500D+02
56        .7180D+02        .2500D+02
57        .8060D+02        .2500D+02
58        .9000D+02        .2500D+02
59        .9720D+02        .2500D+02
60        .1128D+03        .2500D+02
61        .1200D+03        .2470D+02
62        .1300D+03        .2450D+02
63        .1400D+03        .2500D+02
64        .1500D+03        .2550D+02
65        .0000D+00        .3000D+02
66        .1000D+02        .3000D+02
67        .2000D+02        .3000D+02
68        .3000D+02        .3000D+02
69        .4000D+02        .3000D+02
70        .5000D+02        .3000D+02
71        .6000D+02        .3000D+02
72        .7180D+02        .3000D+02
73        .8060D+02        .3000D+02
74        .9000D+02        .3000D+02
75        .9720D+02        .3000D+02
76        .1128D+03        .3000D+02
77        .6000D+02        .3300D+02
78        .7180D+02        .3300D+02
79        .8060D+02        .3300D+02
80        .9000D+02        .3300D+02
81        .6500D+02        .3600D+02
82        .7180D+02        .3600D+02
83        .8060D+02        .3600D+02
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        84      .8500D+02      .3600D+02
        85      .7180D+02      .3900D+02
        86      .8060D+02      .3900D+02


  INPUT          ELEMENT DATA

             CONNECTIVITY   OF ELEMENT NODES
     ELEMENT         #1        #2        #3        #4       MATERIAL

        1             1         2        18        17          1
        2             2         3        19        18          1
        3             3         4        20        19          1
        4             4         5        21        20          1
        5             5         6        22        21          1
        6             6         7        23        22          1
        7             7         8        24        23          1
        8             8         9        25        24          1
        9             9        10        26        25          1
       10            10        11        27        26          1
       11            11        12        28        27          1
       12            12        13        29        28          1
       13            13        14        30        29          1
       14            14        15        31        30          1
       15            15        16        32        31          1
       16            17        18        34        33          1
       17            18        19        35        34          1
       18            19        20        36        35          1
       19            20        21        37        36          1
       20            21        22        38        37          1
       21            22        23        39        38          1
       22            23        24        40        39          1
       23            24        25        41        40          1
       24            25        26        42        41          1
       25            26        27        43        42          1
       26            27        28        44        43          1
       27            28        29        45        44          1
       28            29        30        46        45          1
       29            30        31        47        46          1
       30            31        32        48        47          1
       31            33        34        50        49          2
       32            34        35        51        50          2
       33            35        36        52        51          2
       34            36        37        53        52          2
       35            37        38        54        53          2
       36            38        39        55        54          2
       37            39        40        56        55          2
       38            40        41        57        56          2
       39            41        42        58        57          2
       40            42        43        59        58          2
       41            43        44        60        59          2
       42            44        45        61        60          2
       43            45        46        62        61          2
       44            46        47        63        62          2
       45            47        48        64        63          2
       46            49        50        66        65          3
       47            50        51        67        66          3
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          48         51        52        68        67          3
          49         52        53        69        68          3
          50         53        54        70        69          3
          51         54        55        71        70          3
          52         55        56        72        71          3
          53         56        57        73        72          3
          54         57        58        74        73          3
          55         58        59        75        74          3
          56         59        60        76        75          3
          57         60        61        76        76          3
          58         70        71        77        77          3
          59         71        72        78        77          3
          60         72        73        79        78          3
          61         73        74        80        79          3
          62         74        75        80        80          3
          63         77        78        82        81          3
          64         78        79        83        82          3
          65         79        80        84        83          3
          66         81        82        85        85          3
          67         82        83        86        85          3
          68         83        84        86        86          3

  BOUNDARY CONDITIONS

   NODE    PRESS HEAD      TOTAL HEAD
    84     .000D+00        .360D+02
    80     .300D+01        .360D+02
    75     .600D+01        .360D+02
    76     .600D+01        .360D+02
    61     .113D+02        .360D+02
    62     .115D+02        .360D+02
    63     .110D+02        .360D+02
    64     .105D+02        .360D+02

  NODES ON THE FREE SURFACE OF SEEPAGE

        65    66    67    68    69    70    77    81

 **************

  NODAL  HEADS

 **************

      NODE       TOTAL HD        PRESS HD

        1        .336D+02         .186D+02
        2        .336D+02         .186D+02
        3        .337D+02         .187D+02
        4        .337D+02         .187D+02
        5        .337D+02         .187D+02
        6        .337D+02         .187D+02
        7        .338D+02         .188D+02
        8        .338D+02         .188D+02
  9       .338D+02        .188D+02
 10       .339D+02        .189D+02
 11       .339D+02        .189D+02
 12       .340D+02        .190D+02
 13       .340D+02        .190D+02
 14       .340D+02        .190D+02
 15       .340D+02        .190D+02
 16       .340D+02        .190D+02
 17       .336D+02        .156D+02
 18       .336D+02        .156D+02
 19       .337D+02        .157D+02
 20       .337D+02        .157D+02
 21       .337D+02        .157D+02
 22       .337D+02        .157D+02
 23       .338D+02        .158D+02
 24       .338D+02        .158D+02
 25       .338D+02        .158D+02
 26       .339D+02        .159D+02
 27       .339D+02        .159D+02
 28       .340D+02        .160D+02
 29       .340D+02        .160D+02
 30       .340D+02        .160D+02
 31       .340D+02        .160D+02
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 33       .336D+02        .136D+02
 34       .336D+02        .136D+02
 35       .336D+02        .136D+02
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 50       .318D+02        .682D+01
 51       .318D+02        .682D+01
 52       .318D+02        .684D+01
 53       .318D+02        .682D+01
 54       .321D+02        .711D+01
 55       .332D+02        .822D+01
 56       .339D+02        .892D+01
 57       .343D+02        .926D+01
 58       .347D+02        .967D+01
 59       .349D+02        .988D+01
 60       .351D+02        .101D+02
 61       .360D+02        .113D+02
 62       .360D+02        .115D+02
 63       .360D+02        .110D+02
 64       .360D+02        .105D+02
 65       .300D+02        .000D+00
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      66        .300D+02        .000D+00
      67        .300D+02        .000D+00
      68        .300D+02        .000D+00
      69        .300D+02        .000D+00
      70        .300D+02        .000D+00
      71        .331D+02        .306D+01
      72        .340D+02        .397D+01
      73        .347D+02        .467D+01
      74        .355D+02        .546D+01
      75        .360D+02        .600D+01
      76        .360D+02        .600D+01
      77        .330D+02        .000D+00
      78        .340D+02        .998D+00
      79        .349D+02        .189D+01
      80        .360D+02        .300D+01
      81        .335D+02       -.254D+01
      82        .340D+02       -.198D+01
      83        .350D+02       -.102D+01
      84        .360D+02        .000D+00
      85        .341D+02       -.489D+01
      86        .349D+02       -.413D+01


 *******************************************

  VELOCITIES AT THE CENTER OF THE ELEMENTS

 *******************************************

  ELE   (X)-PERMEABILITY-(Y)      VEL-X        VEL-Y      SATURATION

    1  .200D-02     .200D-02    -.727D-06    .218D-06     .100D+01
    2  .200D-02     .200D-02    -.218D-05    .218D-06     .100D+01
    3  .200D-02     .200D-02    -.364D-05    .220D-06     .100D+01
    4  .200D-02     .200D-02    -.511D-05    .222D-06     .100D+01
    5  .200D-02     .200D-02    -.655D-05    .202D-06     .100D+01
    6  .200D-02     .200D-02    -.769D-05    .128D-06     .100D+01
    7  .200D-02     .200D-02    -.823D-05    .302D-07     .100D+01
    8  .200D-02     .200D-02    -.822D-05   -.308D-07     .100D+01
    9  .200D-02     .200D-02    -.790D-05   -.736D-07     .100D+01
   10  .200D-02     .200D-02    -.742D-05   -.897D-07     .100D+01
   11  .200D-02     .200D-02    -.654D-05   -.155D-06     .100D+01
   12  .200D-02     .200D-02    -.542D-05   -.138D-06     .100D+01
   13  .200D-02     .200D-02    -.406D-05   -.265D-06     .100D+01
   14  .200D-02     .200D-02    -.235D-05   -.248D-06     .100D+01
   15  .200D-02     .200D-02    -.753D-06   -.229D-06     .100D+01
   16  .200D-02     .200D-02    -.727D-06    .582D-06     .100D+01
   17  .200D-02     .200D-02    -.218D-05    .583D-06     .100D+01
   18  .200D-02     .200D-02    -.364D-05    .585D-06     .100D+01
   19  .200D-02     .200D-02    -.511D-05    .591D-06     .100D+01
   20  .200D-02     .200D-02    -.657D-05    .544D-06     .100D+01
   21  .200D-02     .200D-02    -.774D-05    .341D-06     .100D+01
   22  .200D-02     .200D-02    -.826D-05    .783D-07     .100D+01
   23  .200D-02     .200D-02    -.824D-05   -.848D-07     .100D+01
   24  .200D-02     .200D-02    -.792D-05   -.187D-06     .100D+01
   25  .200D-02     .200D-02    -.743D-05   -.288D-06     .100D+01
   26  .200D-02     .200D-02    -.655D-05   -.307D-06     .100D+01
 27  .200D-02    .200D-02    -.547D-05   -.597D-06    .100D+01
 28  .200D-02    .200D-02    -.407D-05   -.658D-06    .100D+01
 29  .200D-02    .200D-02    -.233D-05   -.676D-06    .100D+01
 30  .200D-02    .200D-02    -.746D-06   -.608D-06    .100D+01
 31  .200D-05    .200D-05    -.548D-09    .727D-06    .100D+01
 32  .200D-05    .200D-05    -.161D-08    .729D-06    .100D+01
 33  .200D-05    .200D-05    -.301D-08    .731D-06    .100D+01
 34  .200D-05    .200D-05    -.104D-08    .740D-06    .100D+01
 35  .200D-05    .200D-05    -.326D-07    .697D-06    .100D+01
 36  .200D-05    .200D-05    -.115D-06    .431D-06    .100D+01
 37  .200D-05    .200D-05    -.635D-07    .868D-07    .100D+01
 38  .200D-05    .200D-05    -.428D-07   -.105D-06    .100D+01
 39  .200D-05    .200D-05    -.468D-07   -.239D-06    .100D+01
 40  .200D-05    .200D-05    -.338D-07   -.350D-06    .100D+01
 41  .200D-05    .200D-05    -.164D-07   -.418D-06    .100D+01
 42  .200D-05    .200D-05    -.143D-06   -.647D-06    .100D+01
 43  .200D-05    .200D-05    -.108D-07   -.872D-06    .100D+01
 44  .200D-05    .200D-05     .198D-07   -.837D-06    .100D+01
 45  .200D-05    .200D-05     .185D-07   -.755D-06    .100D+01
 46  .200D-05    .200D-05    -.185D-09    .728D-06    .100D+01
 47  .200D-05    .200D-05    -.517D-09    .729D-06    .100D+01
 48  .200D-05    .200D-05    -.119D-08    .732D-06    .100D+01
 49  .200D-05    .200D-05     .151D-08    .732D-06    .100D+01
 50  .200D-05    .200D-05    -.293D-07    .787D-06    .100D+01
 51  .200D-05    .200D-05    -.417D-06    .455D-06    .100D+01
 52  .200D-05    .200D-05    -.137D-06    .226D-07    .100D+01
 53  .200D-05    .200D-05    -.118D-06   -.920D-07    .100D+01
 54  .200D-05    .200D-05    -.126D-06   -.241D-06    .100D+01
 55  .200D-05    .200D-05    -.105D-06   -.382D-06    .100D+01
 56  .200D-05    .200D-05    -.131D-07   -.406D-06    .100D+01
 57  .200D-05    .200D-05    -.269D-06   -.365D-06    .100D+01
 58  .200D-05    .200D-05    -.612D-06    .394D-07    .100D+01
 59  .200D-05    .200D-05    -.162D-06    .112D-07    .100D+01
 60  .200D-05    .200D-05    -.181D-06   -.818D-07    .100D+01
 61  .200D-05    .200D-05    -.201D-06   -.254D-06    .100D+01
 62  .200D-05    .200D-05    -.150D-06   -.361D-06    .100D+01
 63  .121D-05    .121D-05    -.101D-06   -.109D-07    .000D+00
 64  .198D-05    .198D-05    -.209D-06   -.346D-07    .000D+00
 65  .200D-05    .200D-05    -.308D-06   -.286D-06    .100D+01
 66  .200D-08    .200D-08    -.165D-09   -.616D-10    .000D+00
 67  .200D-08    .200D-08    -.197D-09    .560D-11    .000D+00
 68  .200D-08    .200D-08    -.463D-09    .728D-10    .000D+00


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 SEEPAGE QUANTITIES

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    NODE      SEEPAGE
     84       .227D-05
     80       .258D-05
     75       .523D-05
     76       .443D-05
     61       .803D-05
     62       .875D-05
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   63       .796D-05
   64       .365D-05
   65      -.364D-05
   66      -.728D-05
   67      -.731D-05
   68      -.732D-05
   69      -.754D-05
   70      -.903D-05
   77      -.781D-06

SEEPAGE IN=  .429D-04  SEEPAGE OUT =-.429D-04
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